2007 Heartland Security Conference and Exhibition

"Technology for Defense and Homeland Security Readiness"

9 -11 July 2007

Minneapolis, MN

Agenda

Monday, 9 July 2007

Keynote Address: *Homeland Security Readiness: Today and for the Future,* Hon. Jay Cohen, Under Secretary for Science & Technology, US Department of Homeland Security

Panel Discussion – *Homeland Security: Policy & Technology to Answer the Challenge*
Panelist:

- *Autonomic Mishap Management: Toward Smart Self-healing Critical Infrastructures*, Dr. Massoud Amin, Executive Director, Center for the Development of Technological Leadership, University of Minnesota
- *Adaptive Intelligence for an Adaptive Threat*, Professor Bert W. Tussing, US Army War College, Senior Fellow, George Washington University Homeland Security Policy Institute

Tuesday, 10 July 2007

- *Reagentless Hand-Held Real-Time Evanescent Optical Chem-Bio Detection Using Biominetic Receptor and Ligand Nanosurfaces,* Dr. H. James Harmon, Professor, Department of Physics, Oklahoma State University

- *Countersol: A Scalable Remediation Technology for Radiological Dispersal Devices (RDDs) or "Dirty Bombs",* Dr. Mark Krekeler, Founder & Chief Technology Officer, Mineral Sciences, LLC
- *Triosyn Iodinated Resin Incorporated Into Disposable Respirators,* Mrs. Wava Truscott, Vice President Scientific Affairs of Safelife Corporation, Safelife Corporation

- *Homeland Security Suite (HoSS) - Chemical, Biological and Radiological,* Dr. George Thompson, CEO & President, Chemical Compliance Systems, Inc.
- *Detecting, Locating Impulsive Airburst Events & Providing Discrimination of Event as High-Explosive or Potentially Chemical/Biological Artillery Utilizing Unattended Acoustic Sensors,* Mr. Sachi Desai, Applied Research, Acoustic Center of Excellence, US Army REDCOM-ARDEC

- *Rapid multi-target detection technology – Intellignostics,* Mr. Paul Knapp, Sr., Interim CEO, Intellignostics, Inc., President & CEO, Space Center Ventures
- *Focus on Phase III (Defense Technology Transition & Commercialization) - Partnering with the Department of Defense for Developing Medical & BioDefense Technologies,* Mr. Ray Friesenhahn, SBIR & Technology Transition Manager

Keynote Speaker: *Food Protection & Defense,* Ms. Susan Nestegard, Senior Vice President & Chief Technical Officer, Ecolab

- *Private Sector Needs for Food Defense Solutions,* Dr. Joseph Scimeca, Director, Corporate Regulatory Affairs, Cargill, Inc.
  - *Food Protection & the National Infrastructure Simulation & Analysis Center,* Mr. Paul Kaplan, Senior Technical Staff, Sandia National Laboratories

Wednesday, 11 July 2007

Keynote Speaker: *Command, Control & Interoperability for Homeland Security,* Dr. David Boyd, Division Head, Command, Control & Interoperability Director, Office of Interoperability & Compatibility, US Department of Homeland Security
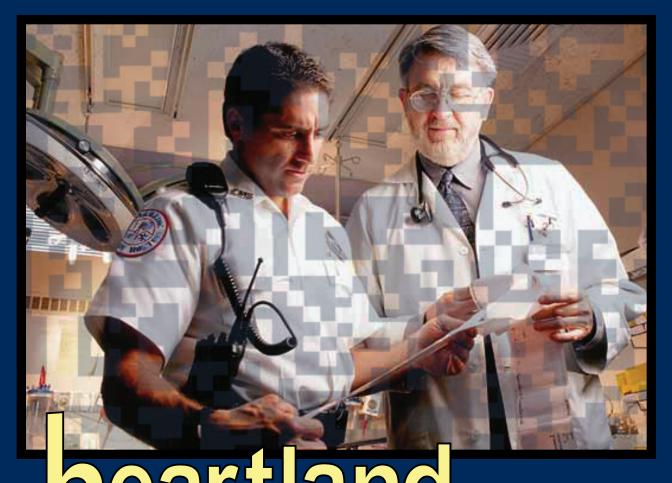
- *National Communications System Priority Telecommunications Services for National Security for Emergency Preparedness Managers and First*

Responders, Mr. Lee Johnson, Regional Outreach Coordinator, National Communications System, US Department of Homeland Security

- *Near Space Communications System for Emergency Response,* Mr. Jerry Quenneville, Vice President & General Manager, Government Programs, Space Data Corporation
- *Reconnaissance Robotics: The Key to Immediate Assessment & Response to Hazardous Situations,* Mr. Alan Bignall, CEO, ReconRobotics

- *Using Modeling and Simulation for Homeland Security Applications,* Dr. Paul Huang, BAE Systems, Armament Systems Division
- *LocalEyes: Asymmetrical C2 for Homeland Security,* Mr. Scott Hume, Lead Information Systems Engineer, Enterprise Integration Planning & Development Department, NetCentric Division, Mitre Corporation

- *Use of Miniature Aerial Vehicles for Traffic Management & Transportation Infrastructure Security*, Professor Gebre-Egziabher, Aerospace Engineering & Mechanics, University of Minnesota
- *Communication Interoperability - A DAILY Problem,* Mr. Mike Greene, Director, Homeland Security Solutions, Information Dominance Systems Electronic Warfare Office, BAE Systems

-

- *Keys to Success for Emergency Preparedness and Disaster Response,* Ms. Kris Eide, Director, Homeland Security & Emergency Management, Department of Public Safety, State of Minnesota
- *Strategies for Innovative Sourcing,* Mr. Jesse S. Aronson, Director of Consulting Services, Center for Innovative Technology

- *Funding Excellence - The SBIR / STTR Program,* Ms. Betsy Lulfs, Director, SBIR / STTR Program, Minnesota Department of Employment and Economic Development
    - *Homeland Security Opportunity Analysis: An Assessment of DHS Budget and Contracting Trends,* Ms. Christiana Balis and Mr. Tim Garnett, The Avascent Group

heartland Security 2007 conference & exhibition

conference agenda

technology for defense and homeland security readiness

in conjunction with:

NATIONAL CENTER FOR
FOOD PROTECTION AND DEFENSE
A HOMELAND SECURITY CENTER OF EXCELLENCE

hyatt regency minneapolis
minneapolis, mn • july 9 - 11, 2007 • event # 7790

conference agenda

monday • july 9, 2007

8:00 am - 2:00 pm	Exhibits Set-Up, Registration Opens

1:00 pm - 5:00 pm — <u>Opening Session - Session I: "Homeland Security" Overview</u>

1:00 pm — Welcome Remarks - NDIA
 • Mr. Sam Campagna, *Director, Operations, NDIA*

1:10 pm — Welcome Remarks - Defense Alliance of Minnesota
 • CDR Chip Laingen, USN (Ret), *Conference Co-Chair, Executive Director, Defense Alliance of Minnesota*

Welcome Remarks - Defense Alliance of Minnesota
 • Mr. Paul J. Wagner, *Founder, Defense Alliance of Minnesota Chairman & CEO, Minnesota Wire & Cable Co.*

1:20 pm — Keynote Address: Homeland Security - A View from Washington
 • Congressman Jim Ramstad, *R-MN-3rd District*

1:50 pm — Keynote Address: Homeland Security Readiness: Today and for the Future
 • Hon. Jay Cohen, *Under Secretary for Science & Technology, US Department of Homeland Security*

2:30 pm — Keynote Address: Effective Preparation and Response to Bio Terrorism
 • Dr. Gregory Poland, *Director, Mayo Vaccine Research Group & Translational Immunovirology and Biodefense*

3:00 pm - 3:20 pm — Afternoon Break - Exhibits Open

3:30 pm - 5:00 pm — Session Continued

3:30 pm — Panel Discussion - Homeland Security: Policy & Technology to Answer the Challenge
<u>Moderator:</u> Mr. Dave Broden, *Conference Co-Chair, Broden Resources Solutions*
<u>Panelists:</u>
 • Hon. Jay Cohen, *Under Secretary for Science & Technology, US Department of Homeland Security*
 • Dr. Massoud Amin, *Executive Director, Center for the Development of Technological Leadership, University of Minnesota*
 • Dr. Gregory Poland, *Director, Mayo Vaccine Research Group & Translational Immunovirology and Biodefense*
 • Mr. Rich Stanek, *Sheriff, Hennepin County*
 • Professor Bert W. Tussing, *US Army War College, Senior Fellow, George Washington University Homeland Security Policy Institute*

4:45 pm — Session Summary - Session Chair
 • CDR Chip Laingen, USN (Ret), *Executive Director, Defense Alliance of Minnesota*

5:00 pm - 6:30 pm — Opening Reception

conference agenda

tuesday • july 10, 2007

7:00 am - 7:00 pm	Registration
7:00 am - 8:00 am	Continental Breakfast
8:00 am - 12:00 pm	**Session Overview - Session II: "Medical & Bio Defense"**

8:00 am — Session Overview - Session Chair
 • Mr. Dave Broden, *Conference Co-Chair, Broden Resources Solutions, LLC*

8:05 am — Keynote Address: Advances in Combat Casualty Care
 • Dr. Greg Beilman, *Colonel, US Army Reserve; Director of Surgical Critical Care, University of Minnesota*

9:00 am — Reagentless Hand-Held Real-Time Evanescent Optical Chem-Bio Detection Using Biominetic Receptor and Ligand Nanosurfaces
 • Dr. H. James Harmon, *Professor, Department of Physics, Oklahoma State University*

9:20 am — Countersol: A Scalable Remediation Technology for Radiological Dispersal Devices (RDDs) or "Dirty Bombs"
 • Dr. Mark Krekeler, **Founder & Chief Technology Officer, Mineral Sciences, LLC**

9:40 am — Disposable Respiratory Protection for Exposure to Airborne Viral Threats
 • **Mrs. Wava Truscott, Vice President Scientific Affairs of Safelife Corporation,** *Safelife Corporation*

10:00 am - 10:20 am	**Morning Break - Exhibits Open**

10:20 am — Homeland Security Suite (HoSS) - Chemical, Biological and Radiological
 • Dr. George Thompson, *CEO & President, Chemical Compliance Systems, Inc.*

10:40 am — Detecting, Locating Impulsive Airburst Events & Providing Discrimination of Event as High-Explosive or Potentially Chemical/Biological Artillery Utilizing Unattended Acoustic Sensors
 • Mr. Sachi Desai, *Applied Research, Acoustic Center of Excellence, US Army REDCOM-ARDEC*

11:00 am — Diagnostic Sensor for Biological Pathogens - Intellignostics
 • Mr. Paul Knapp, Sr., *Interim CEO, Intellignostics, Inc., President & CEO, Space Center Ventures*

11:20 am — Ocular Scanning Instrument: Non-Invasive Chemical Agents & Toxin Screening Technology
 • Dr. Christopher Kolanko, **Chief Scientific Officer, Eyemarker & US Navy Res.**

11:40 am — Twin Star Compartment Monitoring System Catheter & It's Potential Benefit to Injured Soldiers
 • Dr. Andrew Schmidt, *Orthopaedic Surgeon, Hennepin County Medical Center*

12:00 pm — Session Summary - Session Chair
 • Mr. Dave Broden, *Conference Co-Chair, Broden Resources Solutions, LLC*

12:15 pm - 1:30 pm	Luncheon Keynote Speaker: "Air & Transportation Infrastructure Security" Mr. Jeff Hamiel, Executive Director, Metropolitan Airports Commission

1:30 pm - 5:00 pm	<u>Session III - Food Protection & Defense</u>
1:30 pm	Session Overview - Session Chair • Mr. Shaun Kennedy, *Deputy Director, National Center for Food Protection & Defense*
1:35 pm	Keynote Speaker • Ms. Susan Nestegard, **Senior Vice President & Chief Technical Officer, Ecolab**

2:15 pm - 2:30 pm	**Afternoon Break - Exhibits Open**

2:30 pm	Overview, National Center for Food Protection & Defense - A US Department of Homeland Security Center of Excellence • Mr. Shaun Kennedy, *Deputy Director, National Center for Food Protection & Defense*
2:50 pm	Overview, Strategic Partnership Program Agroterrorism Initiative • Mr. John Collier, *Battelle Memorial Institute*
3:10 pm	Food Biological Agent Detection Sensor Program (FBAD) • Dr. Tom McGinn, **Director, Veterinary and Agriculture Security, Office of Health Affairs,** *US Department of Homeland Security*
3:30 pm	Private Sector Needs for Food Defense Solutions • Dr. Joseph Scimeca, *Director, Corporate Regulatory Affairs, Cargill, Inc.*
3:50 pm	Food Protection & the National Infrastructure Simulation & Analysis Center • Mr. Paul Kaplan, *Senior Technical Staff, Sandia National Laboratories*
4:10 pm	Panel Discussion: Challenges for Effective Food Protection & Defense <u>Moderator:</u> Mr. Shaun Kennedy, *Deputy Director, National Center for Food Protection & Defense* <u>Panelists:</u> • Mr. Paul Kaplan, *Senior Technical Staff, Sandia National Laboratories* • Dr. Heidi Kassenborg, *Disease Investigation & Emergency Response Director, Minnesota Department of Agriculture* • Dr. Tom McGinn, **Director, Veterinary and Agriculture Security, Office of Health Affairs,** *US Department of Homeland Security* • Dr. Joseph Scimeca, *Director, Corporate Regulatory Affairs, Cargill, Inc.*
4:55 pm	Session Summary - Session Chair • Mr. Shaun Kennedy*Deputy Director, National Center for Food Protection & Defense*

5:15 pm - 7:00 pm	**Evening Reception**

conference agenda

wednesday • july 11, 2007

7:00 am - 4:30 pm	Registration
7:00 am - 8:00 am	Continental Breakfast

8:00 am - 12:00 pm   <u>Session Overview - Session IV: "Emergency Preparedness & Disaster Response"</u>

8:00 am
Session Overview - Session Chair
• Mr. Dave Broden, *Conference Co-Chair, Broden Resources Solutions, LLC*

8:05 am
Keynote Speaker: Command, Control & Interoperability for Homeland Security
• Dr. David Boyd, *Divison Head, Command, Control & Interoperability Director,* **Office of Interoperability & Compatibility, US Department of Homeland Security**

8:40 am
National Communications System Priority Telecommunications Services for National Security & Emergency Preparedness Managers and First Responders
• Mr. Lee Johnson, *Regional Outreach Coordinator, National Communications System, US Department of Homeland Security*

9:00 am
Near Space Communications System for Emergency Response
• Mr. Jerry Quenneville, *Vice President & General Manager, Government Programs, Space Data Corporation*

9:20 am
Reconnaissance Robotics: The Key to Immediate Assessment & Response to Hazardous Situations
• Mr. Alan Bignall, *CEO, ReconRobotics*

9:40 am
Using Modeling and Simulation for Homeland Security Applications
• Dr. Paul Huang, *BAE Systems, Armament Systems Division*

10:00 am - 10:20 am   Morning Break - Exhibit Hall

10:20 am
LocalEyes: Asymmetrical C2 for Homeland Security
• Mr. Scott Hume, *Lead Information Systems Engineer, Enterprise Integration Planning & Development Department, NetCentric Division, Mitre Corporation*

10:40 am
Use of Minature Aerial Vehicles for Traffic Management & Transportation Infrastructure Security
• Professor Gebre-Egziabher, *Aerospace Engineering & Mechanics, University of Minnesota*

11:00 am
Communication Interoperability - A DAILY Problem
• Mr. Mike Greene, *Director, Homeland Security Solutions, Information* **Dominance Systems Electronic Warfare Office, BAE Systems**

11:20 am
Removing the Language Barrier - Tools for Crises
• Mr. Robert Palmquist, *Founder & CEO, SpeechGear, Inc.*

11:40 am
Panel Discussion - Keys to Success for Emergency Preparedness & Disaster Response
<u>*Moderator:*</u> CDR Chip Laingen, USN (Ret), *Executive Director, Defense Alliance of Minnesota*
<u>*Panelists:*</u>

• Dr. David Boyd, *Director, Command, Control & Interoperability Management, US Department of Homeland Security*
• Ms. Kris Eide, *Director, Homeland Security & Emergency Management, Department of Public Safety, State of Minnesota*
 (Panelists Continued)
• Mr. Lee Johnson, *Regional Outreach Coordinator, National Communications System, US Department of Homeland Security*
• Mr. Jerry Quenneville, *Vice President & General Manager, Government Programs, Space Data Corporation*

12:20 pm	Session Summary - Session Chair • Mr. Dave Broden, *Conference Co-Chair, Broden Resources Solutions, LLC*

12:30 pm - 2:00 pm	Luncheon Keynote Address: Guarding the Homeland - Role of the National Guard Maj Gen Larry Shellito, *Adjutant General, Minnesota National Guard*

2:00 pm - 5:00 pm	<u>Session V - Participation</u>

2:00 pm	Session Overview - Session Chair • CDR Chip Laingen, USN (Ret), *Executive Director, Defense Alliance of Minnesota*

2:05 pm	Creation of the Defense Threat Reduction University (DTRU) • Dr. James Tritten, *Chief, Defense Threat Reduction Agency*

2:25 pm	Homeland Security Opportunity Analysis • Mr. Tim Garnett, *Partner, The Avascent Group* • Ms. Christiana Balis, *The Avascent Group*

2:45 pm	Strategies for Innovative Sourcing • Mr. Jesse S. Aronson, *Director of Consulting Services, Center for Innovative Technology*

3:05 pm	Funding Excellence - The SBIR / STTR Program • Ms. Betsy Lulfs, *Director, SBIR / STTR Program, Minnesota Department of Employment and Economic Development*

3:25 pm	Prevention of Terrorism & Industry's Role • Mr. Sam Brinkley, *Vice President, Homeland & International Security Services, Wackenhut Services, Inc.*

3:45 pm	Panel Discussion - Industry's Response to the Need: Developing the Capability <u>Moderator:</u> Mr. Dave Broden <u>Panelists:</u> • Ms. Christiana Balis, *The Avascent Group* • Mr. Stephen Beitler, *Senior Managing Director, Dunrath Capital* • Mr. Sam Brinkley, *Vice President, Homeland & International Security Services, Wackenhut Services, Inc.* • Mr. Tim Garnett, *Partner, The Avascent Group* • Mr. Harlan Jacobs, *President, Genesis Business Centers, Ltd.*

4:30 pm	Conference Concluding Remarks

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Dealing effectively with a diverse range of existing and emerging threats is the cornerstone of BAE Systems homeland security solutions. The protection of people, assets and infrastructure, while maintaining national security and economic stability is paramount. An effective response requires efficient integration, information sharing and co-operation between a range of traditional and non-traditional security organizations, supported by novel technology and capability insertion by industry.

Homeland security integrates the requirements of many domains, including counter terrorism and asymmetric threat, law enforcement, critical national infrastructure, immigration and national security. BAE Systems has a breadth of capability that enables the analysis and delivery of innovative and scalable solutions and develops technologies to support operations in the security environment, focused on layered system solutions.

BAE Systems is a global defense and aerospace company, delivering a full range of products and services for air, land, and naval forces, as well as advanced electronics, information technology solutions, and customer support services. BAE Systems, with 88,000 employees worldwide, had 2006 sales that exceeded $25 billion.

Minnesota Department of Employment and Economic Development

- SBIR/STTR: The Department serves as the State of Minnesota's focal point to help companies successfully access the more than $2billion each year of federal set-aside dollars to fund high risk, high tech feasibility studies, prototype development and potential commercialization through the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. Staff assist with identification of appropriate federal funding opportunities; review and submit research proposals on behalf of client businesses; conduct program related workshops; and connect businesses to service providers in areas like market analysis, research partnering, and technology commercialization.

- SBAO: The Department's Small Business Assistance Office serves as a first, and continuing, point of contact for information and counsel about the start-up, operation, or expansion of a small business in Minnesota. The majority of inquiries are in the areas of industry and market structure, taxes, and regulatory compliance. The Office is also a publisher of a number of publications on small business related topics, the flagship of which is *A Guide to Starting A Business in Minnesota.*

- SBDC: The Department's Small Business Development Center network delivers high quality, one-to-one counseling and assistance to small businesses in areas like marketing, financing, business planning, adoption and use of technology through a network of nine regional centers throughout Minnesota. All counseling is provided at now charge to the recipient business and training opportunities are priced at very modest charge. This program is supported in part by funds received from the U.S. Small Business Administration.

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Minnesota Wire & Cable Co. (MWCC) is a vertically integrated, custom manufacturing and development house for wire, cable and interconnect assemblies to the Medical, Defense, Instrumentation and Telecommunications industries. MWCC is a market and R&D leader in mitigating tribo-electric effects, radio-translucent wire, innovative connections for wearable electronics, patient monitoring systems, leading-edge medical devices and extruded wire products. Minnesota Defense, the R&D and defense sales division executes high-technology R&D, including projects such as Smart Connector for in-situ wire diagnostics and Komodo stretchy wire for body-borne vests and other applications. MWCC has a surgical products subsidiary, Minnesota Bramstedt Surgical, and a joint venture with Primordial, an in-house software development firm.

The 30,000 square foot headquarters in St. Paul, Minnesota boasts a full R&D and test and measurement center (including an Electromagnetic Capabilities (EMC) chamber for electronic compliance testing). Another high-volume, 30,000 square foot focused-cell production facility is located in Eau Claire, Wisconsin. MWCC is ISO 9001: 2000 certified, ISO 13485: 2003 compliant, ROHS compliant, and is a MIL-STD and IPC-620 certified harness manufacturer.

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Autonomic Mishap Management:
Toward Smart Self-healing Critical Infrastructures

Massoud Amin, D.Sc.
Honeywell/H.W. Sweatt Chair in Technological Leadership
Director, Center for the Development of Technological Leadership (CDTL)
Professor, Electrical & Computer Engineering
University of Minnesota, Twin Cities

Heartland Security Conference
Minneapolis, MN July 9-11, 2007

Some of the material and findings for this presentation were developed while the author was at the Electric Power Research Institute (EPRI) in Palo Alto, CA. EPRI's support and feedback is gratefully acknowledged.
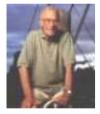

UNIVERSITY OF MINNESOTA

INSTITUTE OF TECHNOLOGY

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S&T Innovation and the Economists

What's really important!

Schumpeter 1883-1953
What's missing? The role of innovation and business 'cycles'

Innovation and 'creative destruction'

Robert Solow (MIT)

Quantitative power of technology in the economy

Technology drives 60% of US economy!

Paul Romer (Stanford Univ.)

The biggest 'force' in wealth creation is not accounted for

Interaction of people and ideas

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Overview: Initiatives and Programs I developed or led at EPRI (1998-2003)

1999-2001	Y2K→2000-present	2002-present	2001-present
EPRI/DoD Complex Interactive Networks (CIN/SI)	**Enterprise Information Security (EIS)**	**Infrastructure Security Initiative (ISI)**	**Consortium for Electric Infrastructure to Support a Digital Society (CEIDS)**

CIN/SI:

Underpinnings of Interdependent Critical National Infrastructures

Tools that enable secure, robust & reliable operation of interdependent infrastructures with distributed intel. & self-healing

EIS:

- Information Sharing
- Intrusion/Tamper Detection
- Comm. Protocol Security
- Risk Mgmt.
- Enhancement
- High Speed Encryption

ISI:

Response to 9/11 Tragedies

- Strategic Spare Parts Inventory
- Vulnerability Assessments
- Red Teaming
- Secure Communications

CEIDS:

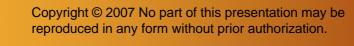- Self Healing Grid
- IntelliGrid™
- Integrated Electric Communications System Architecture
- Fast Simulation and Modeling

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Recent Directions: EPRI/DOD Complex Interactive Network/Systems Initiative

> **"We are sick and tired of them and they had better change!"**
> *Chicago Mayor Richard Daley on the August 1999 Blackout*

Complex interactive networks:

- *Energy infrastructure*: Electric power grids, water, oil and gas pipelines

- *Telecommunication:* Information, communications and satellite networks; sensor and measurement systems and other continuous information flow systems

- *Transportation and distribution networks*
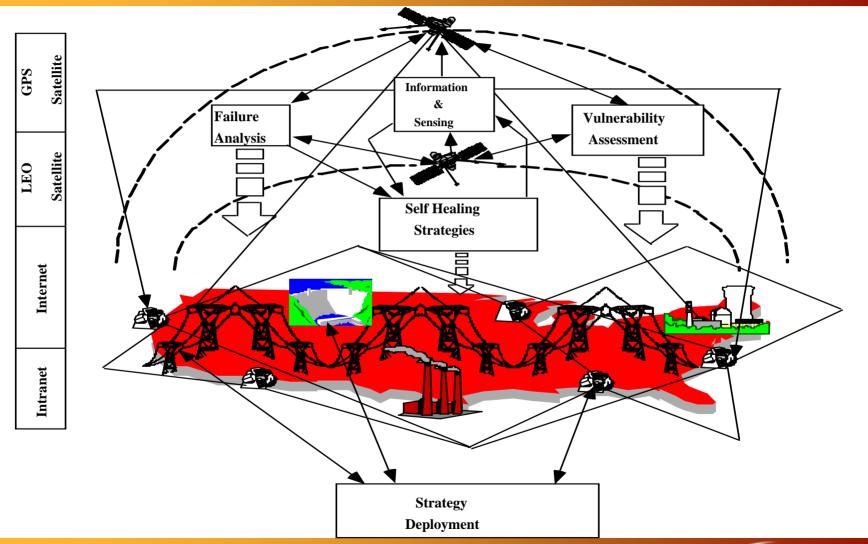
- *Energy markets, banking and finance*

1999-2001: $5.2M / year — Equally Funded by DoD/EPRI

Develop tools that enable secure, robust and reliable operation of interdependent infrastructures with distributed intelligence and self-healing abilities

Complex Interactive Networks

CIN/SI Funded Consortia

107 professors in 28 U.S. universities are funded: Over 360 publications, and 19 technologies extracted, in the 3-year initiative

- U Washington, Arizona St., Iowa St., VPI

- Purdue, U Tennessee, Fisk U, TVA, ComEd

- Harvard, UMass, Boston, MIT, Washington U.

- Cornell, UC-Berkeley, GWU, Illinois, Washington St., Wisconsin

- CMU, RPI, UTAM, Minnesota, Illinois

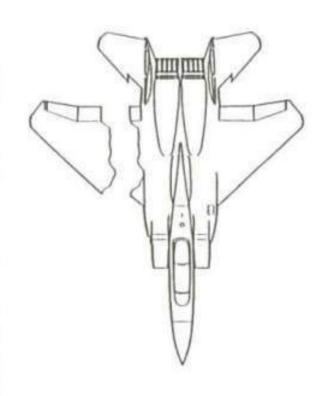- Cal Tech, MIT, Illinois, UC-SB, UCLA, Stanford

- Defense Against Catastrophic Failures, Vulnerability Assessment

- Intelligent Management of the Power Grid

- Modeling and Diagnosis Methods

- Minimizing Failures While Maintaining Efficiency / Stochastic Analysis of Network Performance

- Context Dependent Network Agents

- Mathematical Foundations: Efficiency & Robustness of Distributed Systems

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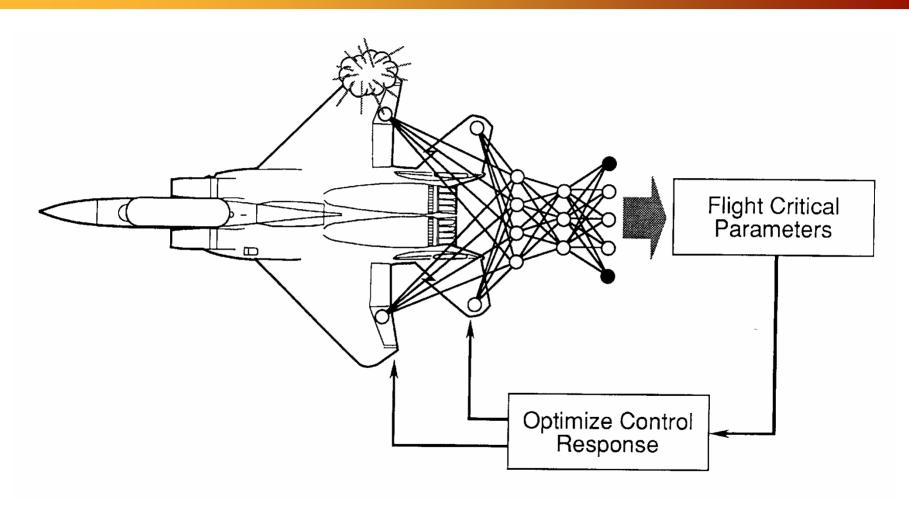# Background:
The Self Healing Grid

Background:
The Case of the Missing Wing

Believe it or not, this one made it back! This F-15, with half its wing missing, is a good example of what is currently considered an "unflyable" aircraft. However, the pilot's success in bringing it home helped to inspire a new program at Aeronautical Systems Division's Flight Dynamics Laboratory aimed at enabling future fighter pilots to fly aircraft with severely damaged control surfaces. The pilot of this F-15 configured in unusual ways the control surfaces that were still working to compensate for the damaged wing. The FDL program will make this "survivors" reaction automatic to the aircraft. Therefore, flying a damaged aircraft will be much easier on the pilot. Through a self-repairing flight control system nearing development, a computerized "brain" will automatically reconfigure such surfaces as rudders, flaperons, and ailerons to compensate for grave damage to essential flying surfaces, according to FDL.

Only smart work by the pilot and the unique combination of interworking control surfaces on the F-15 brought this one back alive. With old-fashioned conventional ailerons and horizontal stabilizer, it couldn't have happened.

NASA/MDA/WU IFCS: NASA Ames Research Center, NASA Dryden Flight Research Center, Boeing Phantom Works, and Washington University in St. Louis.
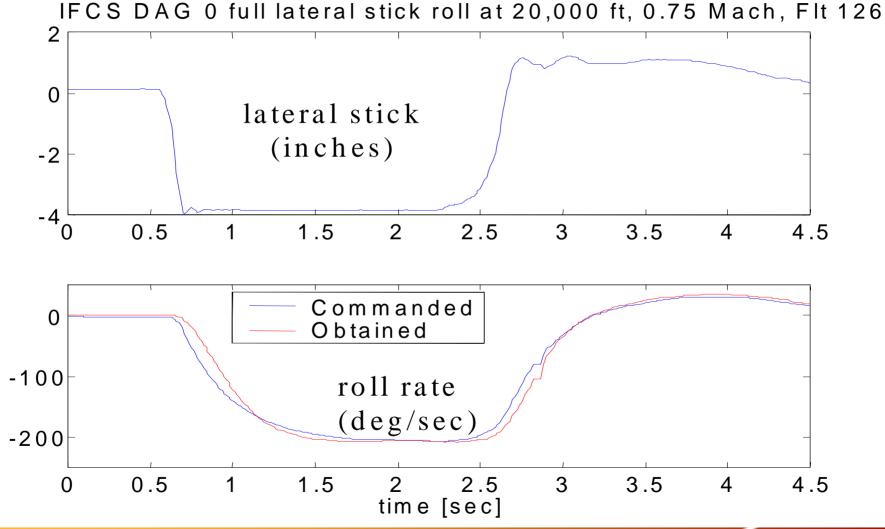
Goal: Optimize controls to compensate for damage or failure conditions of the aircraft*

NASA/MDA/WU IFCS

Roll Axis Response of the Intelligent Flight Control System

IFCS DAG 0 full lateral stick roll at 20,000 ft, 0.75 Mach, Flt 126

lateral stick (inches)

Commanded
Obtained

roll rate (deg/sec)

time [sec]

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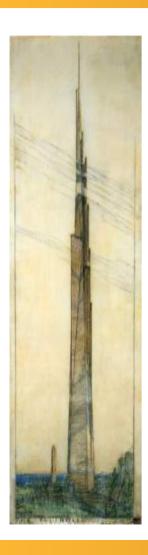Center for the Development of Technological Leadership

Accomplishments in the IFCS program

- The system was successfully test flown on a test F-15 at the NASA Dryden Flight Research Center:
  - Fifteen test flights were accomplished, including flight path control in a test flight envelope with supersonic flight conditions.
  - Maneuvers included 4g turns, split S, tracking, formation flight, and maximum afterburner acceleration to supersonic flight.

- Stochastic Optimal Feedforward and Feedback Technique (SOFFT) continuously optimizes controls to compensate for damage or failure conditions of the aircraft.

- Flight controller uses an on-line solution of the Riccati equation containing the neural network stability derivative data to continuously optimize feedback gains.

- Development team: NASA Ames Research Center, NASA Dryden Flight Research Center, Boeing Phantom Works, and Washington University.

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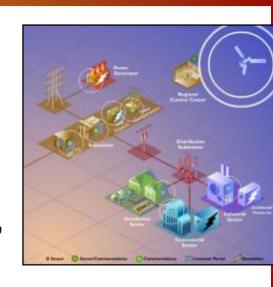of Technological Leadership

Self-healing Grid

Building on the Foundation:

- **Anticipation of disruptive events**
- **Look-ahead simulation capability**
- **Fast isolation and sectionalization**
- **Adaptive islanding**

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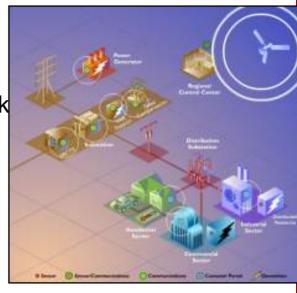*Center for the Development
of Technological Leadership*

What are we doing about it? Enabling Technologies

- Monitoring: WAMS, OASIS, SCADA, EMS:
  - Wide-Area Measurement Systems (WAMS), integrate advanced sensors with satellite communication and time stamping using GPS to detect and report angle swings and other transmission system changes.

- Analysis: DSA/VSA, PSA, ATC, CIM, TRACE, OTS, ROPES, TRELSS, market/risk assessment…
  - Information systems and on-line data processing tools such as the Open Access Same-time Information System (OASIS); and Transfer Capability Evaluation (TRACE) software-- determine the total transfer capability for each transmission path posted on the OASIS network, while taking into account the thermal, voltage, and interface limits.

What are we doing about it? Enabling Technologies (cont.)

- Control: FACTS; Fault Current Limiters (FCL)., …
  - Flexible AC Transmission System (FACTS): Up to 50% more power controlled through existing lines.
  - Fault Current Limiters (FCLs)-- large electrical "shock absorbers" for a few cycles
  - Intelligent Electronic Devices with security built in-combining sensors, computers, telecommunication units, and actuators-- "intelligent agent" functions

- Materials science: High-temperature superconducting cables, advanced silicon devices and wide-bandgap semiconductors for power electronics.

- Distributed resources such as small combustion turbines, solid oxide and other fuel cells, photovoltaics, superconducting magnetic energy storage (SMES), transportable battery energy storage systems (TBESS), etc.

Enabling Technologies (cont.)

An example of a static VAR compensation installation.
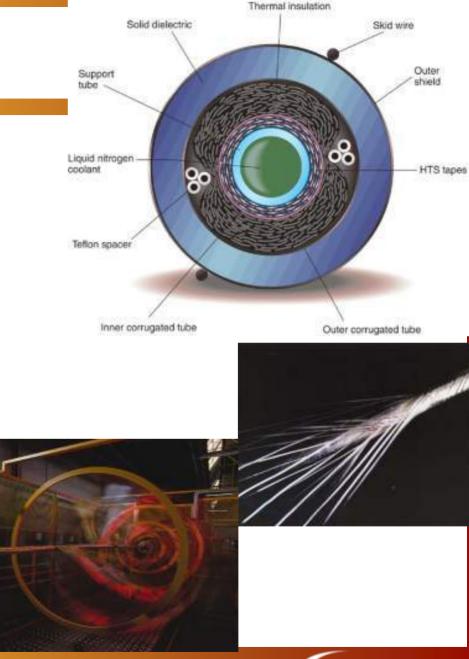
A gas insulated transmission line tunnel in Switzerland.

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Technology Solutions: Maximize Utilization

Superconducting Cables

- 2 to 5 times the current

- Can be used to retrofit existing ducts and pipes

- Need to reduce cost, improve reliability of cryogenic system and gain more operating experience

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Look-Ahead Simulation
Applied to Multi-Resolution Models

- Provides faster-than-real-time simulation
  - By drawing on approximate rules for system behavior, such as power law distribution
  - By using simplified models of a particular system

- Allows system operators to change the resolution of modeling at will
  - Macro-level (regional power systems)
  - Meso-level (individual utility)
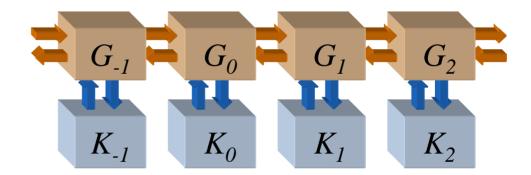 - Micro-level (distribution feeders/substations)

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Control Strategies

- Centralized
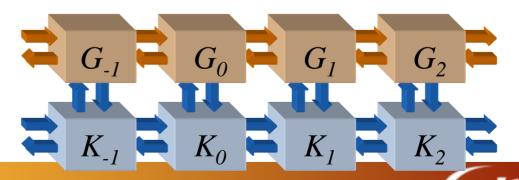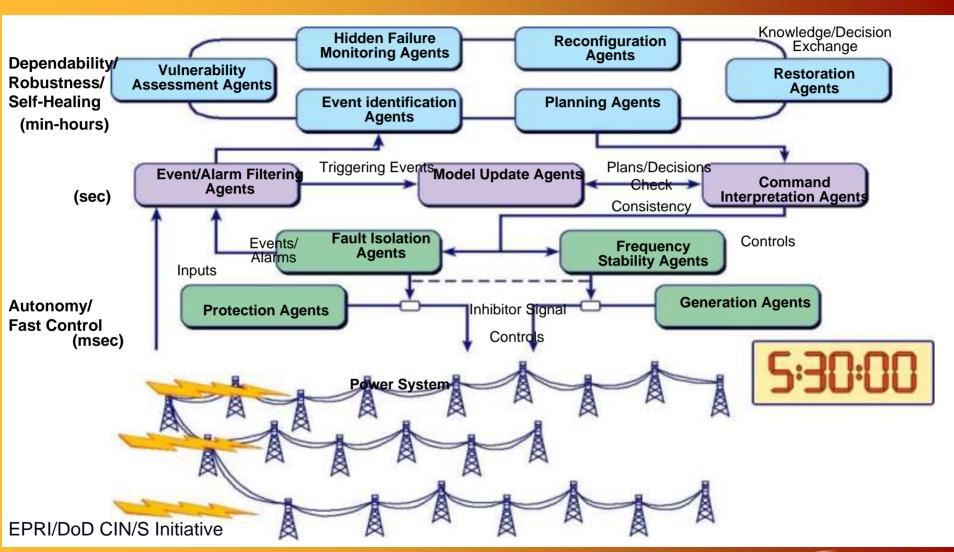
- Perfectly decentralized

- Distributed

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Background: The Self-Healing Grid

Dependability/ Robustness/ Self-Healing (min-hours)

- Vulnerability Assessment Agents
- Hidden Failure Monitoring Agents
- Reconfiguration Agents
- Event identification Agents
- Planning Agents
- Restoration Agents

Knowledge/Decision Exchange

(sec)

- Event/Alarm Filtering Agents
- Model Update Agents
- Command Interpretation Agents

Triggering Events

Plans/Decisions Check

Check Consistency

Autonomy/ Fast Control (msec)

- Fault Isolation Agents
- Frequency Stability Agents
- Protection Agents
- Generation Agents

Events/ Alarms

Inputs

Controls

Inhibitor Signal

Controls

Power System

5:30:00

EPRI/DoD CIN/S Initiative

Background: Intelligent Adaptive Islanding

Legend:
- 230 kV
- 345 kV
- 345 kV
- 500 kV

Background: Simulation Result

No Load Shedding Scheme

New Scheme

EPRI's Reliability Initiative-- Sample Screen of Real-time Security Data Display (RSDD)

What can be Done? Vulnerability Assessment
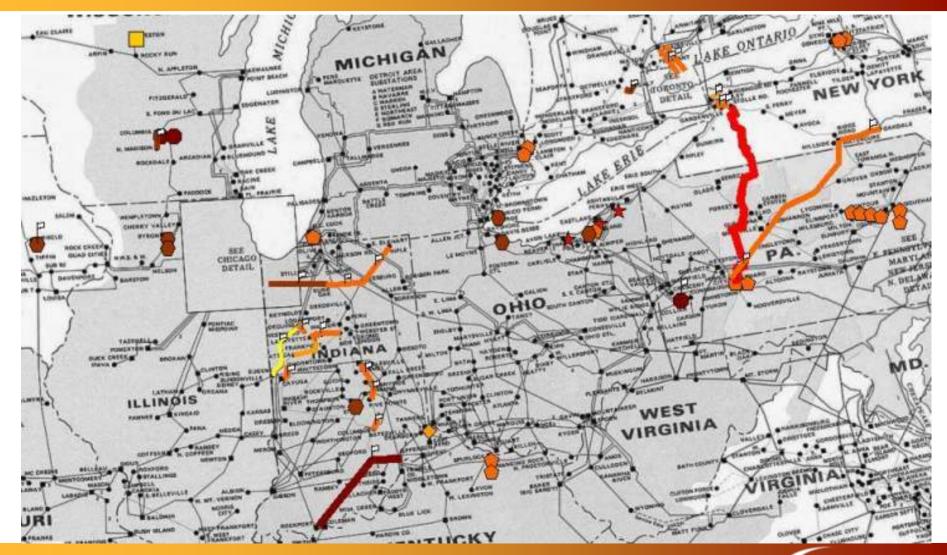
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┌─────────────────┐        ┌─────────────────┐        ┌─────────────────┐
│ Profile Threats │        │                 │        │                 │
│   (Determine    │  ═══>  │ Identify Likely │  ═══>  │ Develop Attack  │
│    Intent &     │        │     Targets     │        │   Scenarios*    │
│  Capabilities)  │        │                 │        │                 │
└─────────────────┘        └─────────────────┘        └─────────────────┘
        ▲                                                       │
        ║                                                       ▼
┌─────────────────┐   ┌─────────────────┐   ┌──────────────┐   ┌──────────────┐
│     Apply       │   │    Develop      │   │ Assess Risks │   │    Assess    │
│   War Gaming    │<══│   Counter-      │<══│ (probability │<══│Vulnerabilities│
│    Theory       │   │   measures      │   │of successful │   │ to each Attack│
│                 │   │                 │   │attack x impact)│ │              │
└─────────────────┘   └─────────────────┘   └──────────────┘   └──────────────┘
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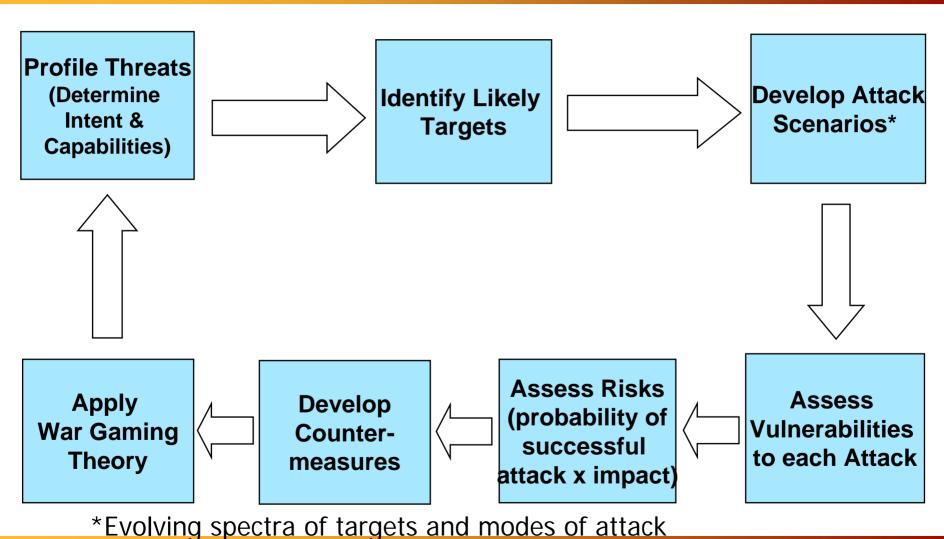
*Evolving spectra of targets and modes of attack
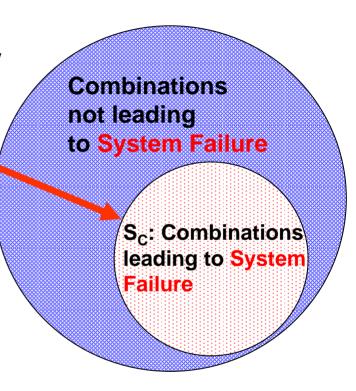
Systems Control Challenge
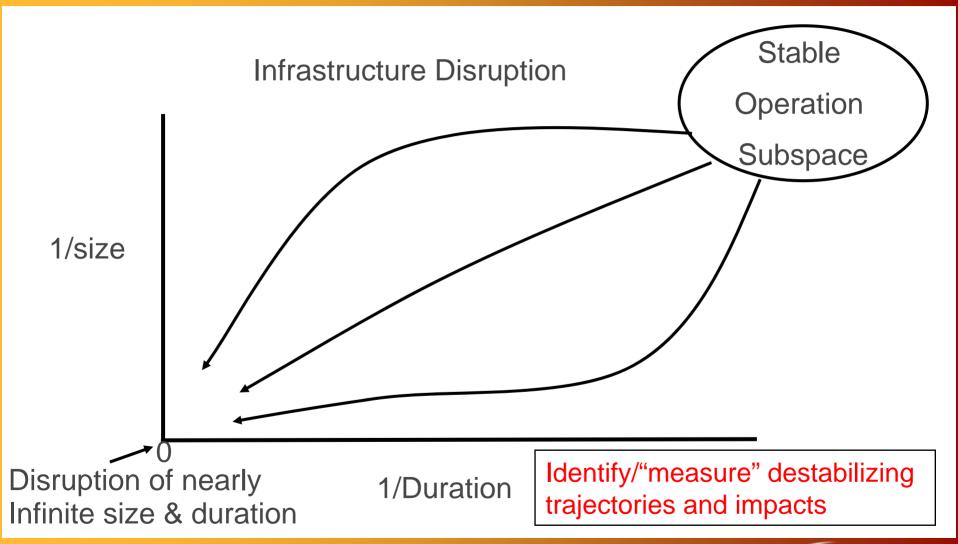
- Enhancing Reliability and Security of Network Operation via quantification of the system state and its "direction/speed/momentum" toward a major failure

- Making Network Availability (quick restoration) a key requirement

- Introducing Quality of Service as an additional constraint

- Ultimately, enabling operators to act more efficiently and with greater confidence in difficult (sometimes unclear, unexpected or even conflicting) circumstances

Combinations not leading to System Failure

S_C: **Combinations leading to System Failure**

Which trajectories lead to catastrophic failures?

An Assessment Methodology

Infrastructure Disruption

Stable Operation Subspace

1/size

1/Duration

0

Disruption of nearly Infinite size & duration

Identify/"measure" destabilizing trajectories and impacts

Objectives:

- Identify the most significant Science & Technology innovations which would meet energy service needs over the next 10 or 20 years;

- Determine Science & Technologies areas and concepts which address customer aspirations and hopes; when conceived, they will lead to:
  - Technologies that encourage job creation and address the needs of the society;
  - An energy system so robust and resilient that it will not fail;
  - A totally reliable, secure communication system that will not fail.

Source: Galvin Electricity Initiative www.galvinelectricity.org

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S&T Policy Challenges

Four Threats To U.S. Science and Technology In The Future
– ALL OF WHICH ARE, IN PART, 'POLITICAL'
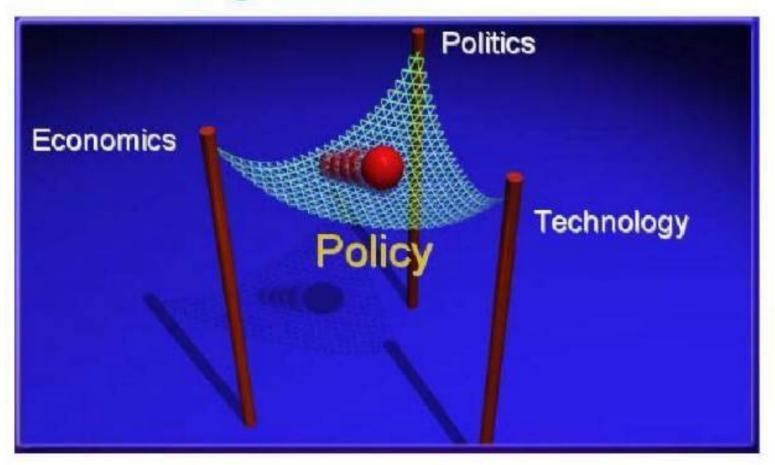
- MONEY TO FUND Science and Technology

- PEOPLE TO DO Science and Technology

- PUBLIC UNDERSTANDING AND TRUST In Science

  – LEADERSHIP and SUSTAINED COMMITMENT

- INTERNATIONAL COOPERATION

  – PARTICULARLY DIFFICULT IN A POST 9/11 WORLD

Unresolved Issues Cloud Planning for the Future

Restructuring Trilemma

Recommendations

- Establish the "Smart Grid" as a national priority

- Authorize increased funding for R&D and demonstrations of the "Smart Grid"

- Revitalize the national public/private electricity infrastructure partnership needed to fund the "Smart Grid" deployment

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Discussion and the Road Ahead

- What are the key security issues facing the world, our nation, MN and industry?

  – **What is your vision for the future– what will it look like or how securely will it perform in 2008-2020?**

  – **What are the difficult challenges to overcome to achieve your vision?**

  – **What enabling security technologies and policies are needed to address these?**

  – **What critical issues should we consider in beginning plans for in 2008 and beyond?**

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Thank you

Strategies for Innovation Sourcing

11 July 2007

Jesse Aronson, PE, PMP
Center for Innovative Technology
Herndon, VA
jaronson@cit.org / 703-689-3011

Objectives

- Describe ways to identify and harness the wealth of innovation to address challenging problems in Homeland Security
- Look at strategies for effectively navigating the "innovation bazaar"

The Innovation Sourcing Challenge

CIT CONNECT
CENTER FOR INNOVATIVE TECHNOLOGY

- **There is not a shortage of ideas. The challenge is in finding the good ones and the right ones …**

Case Study 1:

-6,000 ideas yielded 100 marketable ideas

(Consumer Products)

Case Study 2:
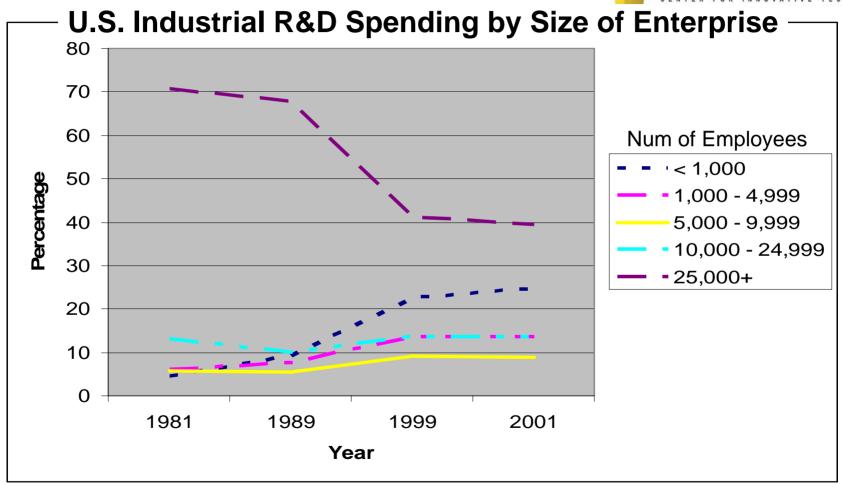
-3,000 candidates yielded 15 applicable technologies

(Intelligence Agency)

… and bringing them into the government sector

The Importance of Innovation Sourcing Continues to Grow

U.S. Industrial R&D Spending by Size of Enterprise

Innovation is migrating from government/corporate labs to small businesses

Examples of Proactive Innovation Sourcing

- Proctor & Gamble Connect + Develop
  - Like an Open BAA
- Staples InventionQuest
  - Looking to build the company's brand
- CTTSO Technical Support Working Group (TSWG)
- Government Venture Capital organizations

Best Practices for Innovation Sourcing

- Know What You're Looking For

- Execute with Focus

- Find a Guide

- Plan for Transition
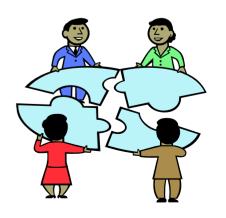
** Extra Credit **

FAR Part 10 requires "market research to arrive at the most suitable approach to acquiring, distributing, and supporting supplies and services."

Know What You're Looking For

- What gaps are you trying to fill?
- Are some areas more vulnerable to "not invented here?"
- What maturity levels can you accept?
- Variables: Reach, Cost, Risk, Speed

Find a Guide

- Innovation Intermediaries
  - Agents that actively seek out innovation
  - Facilitate the innovation market
- Types
  - Marketplaces, agents, brokers, market-makers, innovation capitalists, incubators, VCs
- Value
  - "Ear to the ground"
  - Territorial knowledge
  - Anonymity

Execute with Focus

- Time constraints lead to results
  - But keep an open door too
- Understand the needs before you begin the search

Plan for Transition
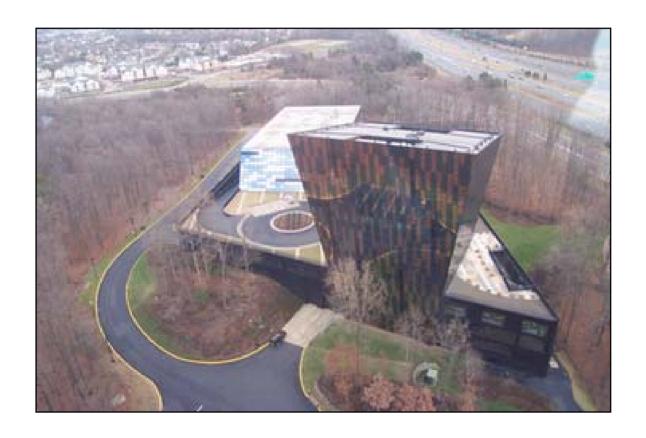
- How can small, dynamic companies fit with a multi-year acquisition program?

- How do you coax an ant into a room full of elephants?

Questions

Homeland Security Opportunity Analysis:

An Assessment of DHS Budget and Contracting Trends

Christina Balis and Tim Garnett

THE Avascent GROUP
analysis · vision · results

The Avascent Group, formerly DFI Corporate Services, is a leading provider of strategy and management consulting services to global leaders in homeland security, defense, aerospace, logistics, transportation and high technology

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analysis · vision · results
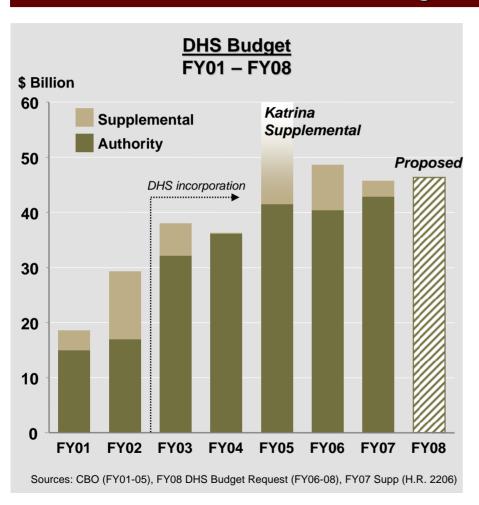
About The Avascent Group

➢ **The Avascent Group was formed in February 2007 via a management buyout of DFI Corporate Services**

➢ **We provide strategy and management consulting services to firms operating at the nexus of business and government**

➢ **We specialize in serving firms in the defense, aerospace, homeland security, logistics, information technology, and technical services industries**

➢ **For more information, please visit www.avascent.com**

DHS spending remains robust, though below the FY06 peak following Hurricane Katrina

DHS Budget Trends

DHS Budget FY01 – FY08

$ Billion

Legend:
- Supplemental
- Authority

- Katrina Supplemental (FY05)
- DHS incorporation (FY03–FY04)
- Proposed (FY08)

Chart axis: 0, 10, 20, 30, 40, 50, 60
Categories: FY01, FY02, FY03, FY04, FY05, FY06, FY07, FY08

FY08 Major Budget Trends

- **2007 $42.8B plus $2.9B Supplementals**
  - More than $700M in supplemental funds reserved for aviation security and State & Local grants

- **2008 $46.4B**
  - 8% growth from 2007
  - 8% CAGR (not including Supplementals) since DHS incorporation in 2003
  - Growth across most agencies
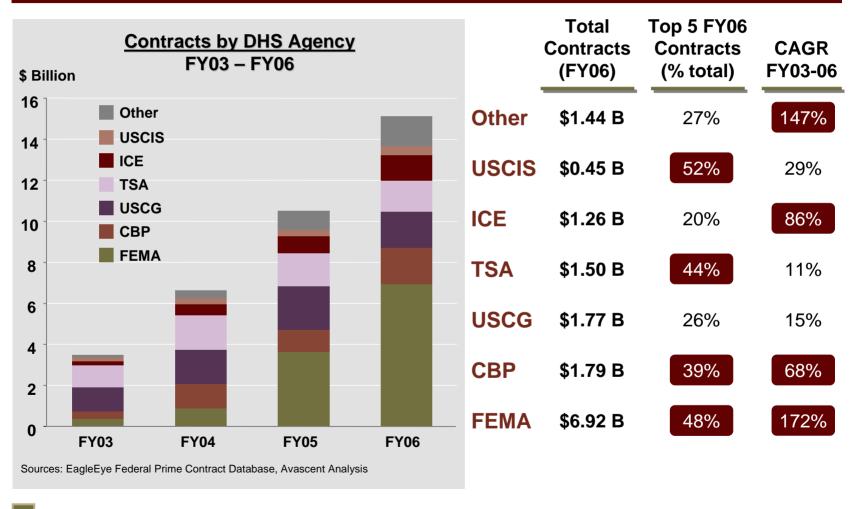
- **R&D priorities at S&T, DNDO and OHA**
  - Continued spending on CBRNE technologies (current and next-gen)
  - S&T dedicating approximately $80M to innovative high-risk technologies

Despite net increases in virtually all agencies' budgets, not all growth will present opportunity for significant industry involvement

The fastest growth in contracting in recent years has taken place within FEMA, CBP, ICE, as well as select new offices and R&D programs under DHS

DHS Contracting Trends

Contracts by DHS Agency
FY03 – FY06

$ Billion

Legend:
- Other
- USCIS
- ICE
- TSA
- USCG
- CBP
- FEMA

Sources: EagleEye Federal Prime Contract Database, Avascent Analysis

	Total Contracts (FY06)	Top 5 FY06 Contracts (% total)	CAGR FY03-06
Other	$1.44 B	27%	147%
USCIS	$0.45 B	52%	29%
ICE	$1.26 B	20%	86%
TSA	$1.50 B	44%	11%
USCG	$1.77 B	26%	15%
CBP	$1.79 B	39%	68%
FEMA	$6.92 B	48%	172%

A handful of contracts account for a large share of contracting dollars within FEMA, CBP, TSA, and USCIS

Border & Immigration is the largest DHS market segment; Transportation & Protection remains large but funds are largely committed
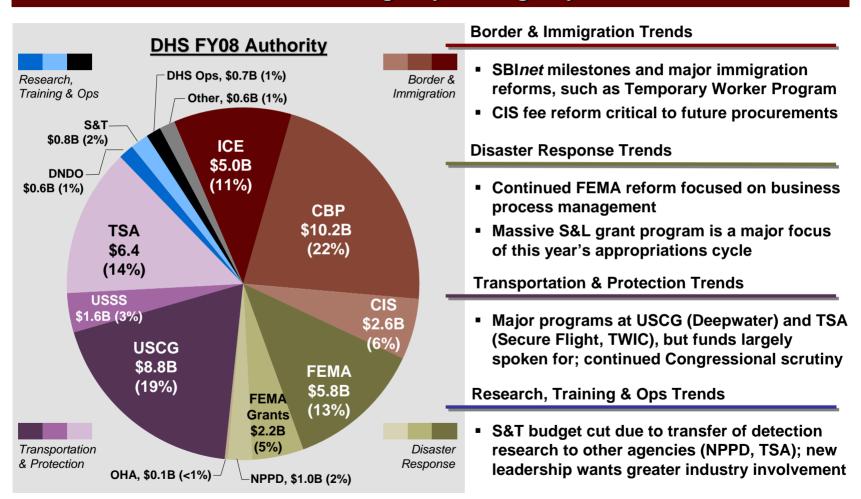
FY08 Budget by DHS Agency

DHS FY08 Authority

Research, Training & Ops

DHS Ops, $0.7B (1%)

Other, $0.6B (1%)

S&T $0.8B (2%)

DNDO $0.6B (1%)

ICE $5.0B (11%)

CBP $10.2B (22%)

TSA $6.4 (14%)

USSS $1.6B (3%)

USCG $8.8B (19%)

CIS $2.6B (6%)

FEMA $5.8B (13%)

FEMA Grants $2.2B (5%)

OHA, $0.1B (<1%)

NPPD, $1.0B (2%)

Transportation & Protection

Disaster Response

Border & Immigration

Border & Immigration Trends

- **SBI***net* **milestones and major immigration reforms, such as Temporary Worker Program**
- **CIS fee reform critical to future procurements**

Disaster Response Trends

- **Continued FEMA reform focused on business process management**
- **Massive S&L grant program is a major focus of this year's appropriations cycle**

Transportation & Protection Trends

- **Major programs at USCG (Deepwater) and TSA (Secure Flight, TWIC), but funds largely spoken for; continued Congressional scrutiny**

Research, Training & Ops Trends

- **S&T budget cut due to transfer of detection research to other agencies (NPPD, TSA); new leadership wants greater industry involvement**

CBP, CIS and DNDO all post double-digit budget growth, whereas the S&T Directorate is receiving an 18 percent decline

Despite net funding increases at almost every DHS agency, only a few organizations present significant near-term opportunity

FY08 Opportunity Assessment

	Agency	Net $ Change	Major Trends	Opportunity Assessment
Immigration	ICE	+$288M	*Spending increases are focused on adding staff, rather than technology*	⬍
	CBP	+$829M	*Significant personnel & infrastructure resources, strong focus on first SBInet task orders*	⬆
	CIS	+$582M	*Critical next two years as CIS undergoes fee reform and modernization to lay foundation for TWP*	⬆
Disaster Response	FEMA	+$329M	*Despite massive funding for State & Local grants, FEMA does not yet have mature procurement*	⬍
	NPPD	+$105M	*Lost a number of programs to FEMA, but retains chemical security and biometric collection/sharing*	⬍
	OHA	+$118M	*Transfer of BioWatch and and BWIC from S&T requires OHA to significantly increase its role at DHS*	⬆
Transportation & Protection	USCG	+$99M	*Remains an important industry customer, programs proceed incrementally, but no new FY08 opportunities*	⬇
	USSS	+$132M	*Agency is neither well integrated nor a major procurer, budget is largely personnel and one-time costs*	⬇
	TSA	+$138M	*Workforce enhancements remain high priority, checkpoint redesign lurks in the future*	⬍
Research, Training & Ops	DNDO	+$81M	*DNDO will continue to procure heavily both current and next-generation technology*	⬆
	S&T	-$49M	*New leadership is trying to dramatically increase relevance to both DHS customers and industry*	⬍
	Dept Ops	+$57M	*Despite many programs, opportunities are small in scope and involve software solutions*	⬍

Six macro priorities are driving DHS-wide spending objectices

FY08 Macro Priorities

Comprehensive Immigration Reform

- **SBI**
  - Largest funding item for 2008
- **CIS Processing Capacity**
  - Modernization critical to building credibility for TWP
- **Detention Capacity**
  - Needs more efficient processing to support significant interior activity

Biometrics and ID Programs

- **USVISIT**
  - Focus on building increased biometric interoperability; exit not a priority
- **WHTI**
  - Significant infrastructure outlays
- **Real ID**
  - Deadline for state implementation spring 2008

Transportation Security

- **Air Cargo**
  - Congressional pressure to inspect/screen 100% on passenger planes
- **Securing the Cities**
  - Technology for NYC pilot to be deployed by end of 2008
- **TWIC**
  - Expect next phase to include infrastructure

Bio-security and Public Health Emergencies

- **OHA**
  - New OHA with biological detection and response authorities
  - Important role with State and Locals given BioShield and Medical Readiness activity

Nuclear Detection and Chemical Facility Security

- **RPM Deployment and Next-Generation Research**
  - Deployed technology to scan 99% of containerized cargo
  - Policy questions regarding overseas screening
- **Chemical Site Security Office**
  - New regulations in place

Federal Response to Hazards and Disasters

- **State & Local Assistance**
  - More defined, categorical approach to grants
- **FEMA Retooling**
  - Vision for a new FEMA
- **Workforce Enhancements**
  - Converting cadre of on-call response employees

Business with DHS will become increasingly relationship based

Customer Lessons Learned

On-schedule Deliveries for Existing Programs	- **Premium on delivery, especially for high-profile programs** - **No surprises – keep client informed of any challenges or delays** - **Increasing use of performance metrics**
Low-risk Technical Solutions	- **Low-risk solutions = new business wins (e.g. SBI*net*, TWIC)** - **Eagle/First Source as preferred vehicle** - **Watch SBI*net* closely** - **Personal relationships are important to build customer trust**
Small Business Partnerships	- **Eagle Small Business as the critical vehicle** - **Incumbent small businesses provide additional customer comfort** - **Small business teaming opportunities increase program access**
Public Support of Key Programs	- **Bite back in the press where necessary** - **Industry invited/required at more Congressional hearings** - **Proactively manage messaging and public perception with DHS customer**

Know Before You Go™

Reconnaissance Robotics:

The Key to Immediate Assessment & Response to Hazardous Situations

Agenda

- Introductions
- The Recon Scout™
- Driving Need
- Market and Customers
- The Future
- Q & A

The Recon Scout™

ROBOTS BEFORE PEOPLE!

Know Before You Go ™

Welcome and Introductions

- Team
  - Alan Bignall, President and CEO
  - The three main inventors/engineers from the University of Minnesota: Ian Burt, Casey Carlson and Andrew Drenner
  - New sales team and resellers led by David Gustafson
  - Strategic "All Minnesota" Based Partners:
    - Ryan Douglas, Manufacturing (MFG Solutions Inc)
    - Mohammed Nouri, Amex Inc - ReconRobotics International
    - Jack Klobucar, Marketing & PR (Value Added Inc)
    - Mary Wilson, C.P.A. - CFO
- The Recon Scout™

The Recon Scout™

The Recon Scout™

The Recon Scout™
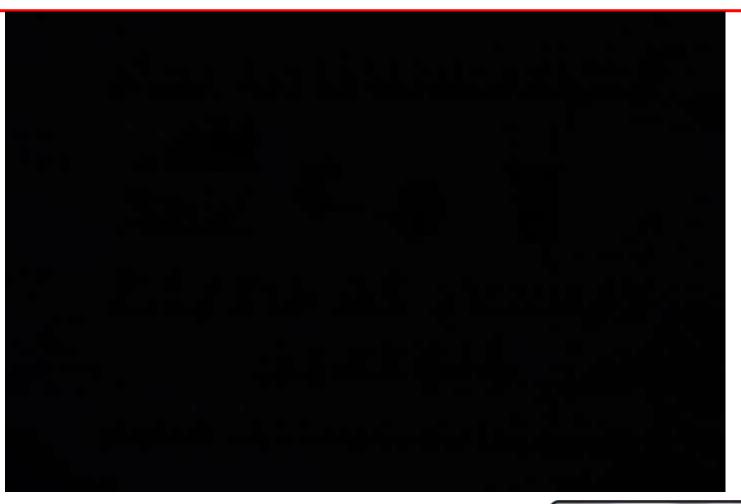
- One Pound - Man Portable
- Throwable or Launchable
- One Button Remote Control
- Hardened - Works when Needed Most
- Disposable but Rechargeable
- Simple, Simple, Simple

The Recon Scout In Action

The Recon Scout In Action

Current Distribution

- Direct Sales in the US

- ReconRobotics International outside the US

- US Sales/Distributor partnerships with
  - Raymar CA
  - Pinnacle CA
  - ADS (multiple states)
  - Zistos NY
  - Fischer Safety all states
  - ETG all states

Current Markets

- Local and State Police
- SWAT and Tactical Teams
- International Police and Military
- Fire Departments and Search and Rescue
- Marines
- USSOCOM Fort Bragg
- State Departments of Corrections
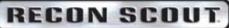
Customers

- California
- Arizona
- North Carolina
- New York
- Texas
- Alabama
- United Kingdom
- France
- Spain
- Israel
- Poland

2007 Product Pricing

- Robot Kit $6,500
- Annual Maintenance $1,000
- Command Monitoring Station $2,500
- Replacement robot only $4,500

The Future - Save Lives

- Infrared Sensors

- Chemical Sensors

- Biological Sensors

- Explosive Sensors

- Nuclear Sensors

- Multiple Robots Operating Together
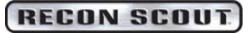
Where You Can See Us

- Star Tribune May 2007
- National Geographic Special Fall 2007
- Discovery Channel - Future Weapons TBD
- Wired Magazine - NextFest 2007 - Los Angeles
- Police.com product write up TBD

Know Before You Go™

Q & A

Emergency Response Communications

Heartland Security Conference & Exhibition

Dr. David Boyd
Director
Command, Control and Interoperability
Science and Technology Directorate
July 11, 2007

Communication Challenge on the Frontlines

Emergency responders—police officers, fire personnel, emergency medical services—need to share vital voice and data information across disciplines and jurisdictions to successfully respond to day-to-day incidents and large-scale emergencies.
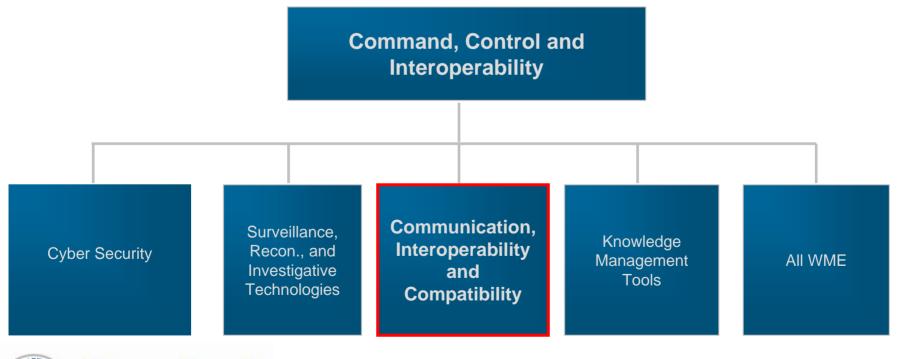
Responders often cannot talk to some parts of their own agencies—let alone across cities, counties, and states. Ineffective communications risk the lives of responders in the field, and can mean the difference between life and death for those awaiting help.

Homeland Security

Command, Control and Interoperability

The mission of the Science and Technology (S&T) Directorate's Command, Control and Interoperability Division is to transform new and promising concepts into real operational capabilities. With its Federal partners, the Division is working to strengthen communications interoperability, improve Internet security and integrity, and accelerate the development of automated capabilities to help identify potential national threats.

```
                    ┌─────────────────────────────┐
                    │   Command, Control and      │
                    │      Interoperability       │
                    └─────────────────────────────┘
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| Cyber Security | Surveillance, Recon., and Investigative Technologies | Communication, Interoperability and Compatibility | Knowledge Management Tools | All WME |

OIC Background

The Office for Interoperability and Compatibility (OIC) is working with the emergency response community and Federal partners to improve local, tribal, state, and Federal emergency preparedness and response. OIC's communications portfolio is comprised of the research, development, testing, evaluation, and standards aspects of the SAFECOM and Disaster Management (DM) programs.

OIC is committed to developing tools—methodologies, templates, models, and educational materials—that effectively meet the critical needs of emergency responders in the field.

Homeland Security

4

Voice and Data Interoperability Programs

OIC addresses both voice and data interoperability

Voice Interoperability

OIC is creating the capacity for increased levels of interoperability by developing tools, best practices, and methodologies that emergency response agencies can put into effect immediately.

Data Interoperability
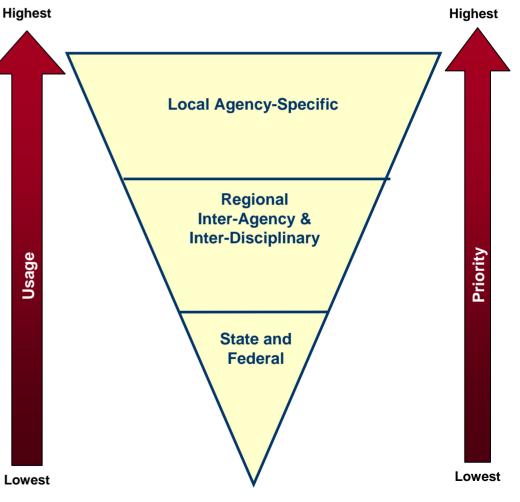
OIC's DM program is improving incident response and recovery by developing tools and messaging standards that help emergency responders manage incidents and exchange information in real time.

Practitioner-Driven Approach
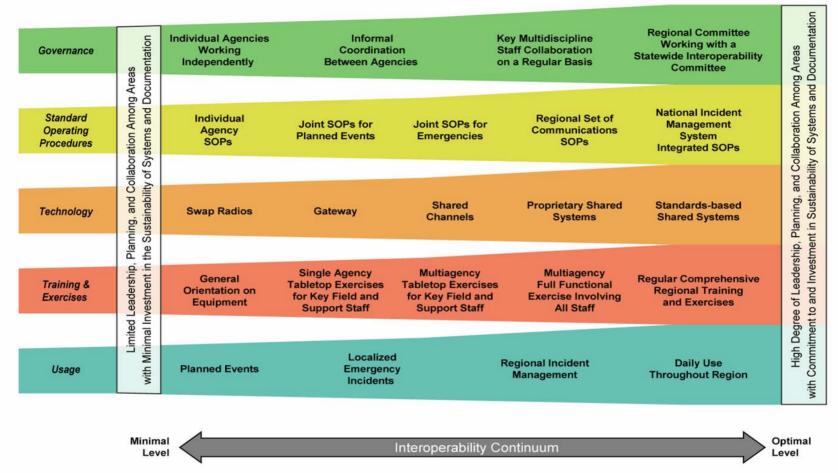
- A successful strategy for improving interoperability must be based on user needs and driven from the bottom up.

- OIC advocates a unique, practitioner-driven governance structure. OIC benefits from the critical input of the emergency response community and from local, tribal, state, and Federal policy makers and leaders. This input ensures that OIC resources are aligned with responders' needs.

Highest

Usage

Lowest

Local Agency-Specific

Regional Inter-Agency & Inter-Disciplinary

State and Federal

Highest

Priority

Lowest

Homeland Security

Multi-Dimensional Challenge
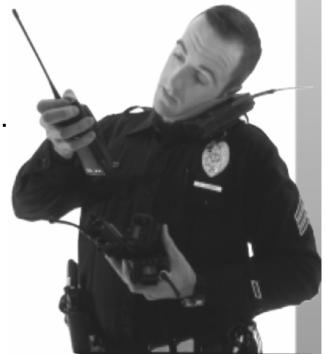
A national strategy for improving interoperability must take into account all of the factors critical for a successful interoperability solution.

Beyond Technology Solutions

• Interoperability is not solely a technology problem that can be solved with the "right" equipment or the "right" communications system.

• Some technology solutions are useful for command elements, but are hopelessly impractical for individual emergency responders.

• There are not any "silver bullet" solutions.

• Achieving interoperability involves tactical, technological, strategic, and cultural changes.

Baseline Survey Findings

- Fire/emergency medical service and law enforcement agencies tend to show the same degree of development across three-quarters of the Interoperability Continuum topics.

- State-local interoperability tends to be at a less-advanced stage than cross-discipline and cross-jurisdiction interoperability.

- Small agencies—whether measured by staff or population served—tend to be at less advanced stages of development than larger agencies.

- Agencies that operate on large, shared systems tend to be at more advanced stages of development than those that operate on stand-alone systems.

- Agencies are least advanced in the non-technology elements.

- Two-thirds of the agencies use interoperability to at least a moderate degree.

OIC Tools and Resources

OIC is committed to developing tools that emergency responders can use immediately.

OIC tools—methodologies, templates, models, and educational materials—capture:

- Best practices and lessons learned from the field

- Practitioner-driven requirements

- Input from emergency responders nationwide

New Tools and Resources

- **Writing Guide for Standard Operating Procedures (SOPs) Challenge**: Tool that provides instructions to assist emergency responders in creating effective SOPs

- **Writing Guide for a Memorandum of Understanding**: Tool that provides information on creating a framework for mutual accountability among multiple jurisdictions

- **Multi-Agency Interoperability Committee Charter Template**: Tool that provides questions for consideration and example text to assist practitioners with the creation of a charter for a multi-agency communications interoperability committee

- **Improving Interoperability Through Shared Channels**: Guide to assist state and local interoperability coordinators with creating a regional channel plan

Homeland
Security

Acceleration of Standards

The acceleration of standards is a key component of both voice and data interoperability. In particular, DM focuses on messaging and information sharing standards.

- OIC supports the acceleration of Project 25 (P25) standards that help produce equipment that is interoperable and compatible regardless of manufacturer. P25 is a suite of eight standards intended to help produce equipment with such characteristics.

- At the request of Congress, OIC is working with the National Institute of Standards and Technology, the Department of Justice, and the P25 Steering Committee to develop and implement a Compliance Assessment Program. It will validate that P25 standardized systems are indeed P25-compliant. Also that equipment from different manufacturers can interoperate. This will help ensure Federal grant dollars are being used appropriately.

- DM leads the Information Exchange Standards Initiative, a public-private partnership to create messaging standards to share information between disparate incident management systems and software applications.

Heartland Security 2007
St. Paul, Minnesota

Homeland Security Readiness: Today and for the Future

Jay H. Cohen
Under Secretary
Department of Homeland Security
Science and Technology Directorate
July 9, 2007

Homeland Security

S&T Goals

- Accelerate delivery of enhanced technological capabilities to meet requirements and fill capability gaps to support DHS Agencies in accomplishing their mission

- Establish a lean and agile GS-manned, world-class S&T management team to deliver the technological advantage necessary to ensure DHS Agency mission success and prevent technology surprise

- Provide leadership, research and educational opportunities and resources to develop the necessary intellectual basis to enable a national S&T workforce to secure the homeland

Homeland Security

DHS S&T Investment Portfolio
Balance of Risk, Cost, Impact, and Time to Delivery

Product Transition (0-3 yrs)	Innovative Capabilities (1-5 yrs)
▪ Focused on delivering near-term products/enhancements to acquisition ▪ Customer IPT controlled ▪ Cost, schedule, capability metrics	▪ High-risk/High payoff ▪ "Game changer/Leap ahead" ▪ Prototype, Test and Deploy ▪ HSARPA
Basic Research (>8 yrs)	**Other (0-8+ yrs)**
▪ Enables future paradigm changes ▪ University fundamental research ▪ Government lab discovery and invention	▪ Test & Evaluation and Standards ▪ Laboratory Operations & Construction ▪ Required by Administration (HSPDs) ▪ Congressional direction/law
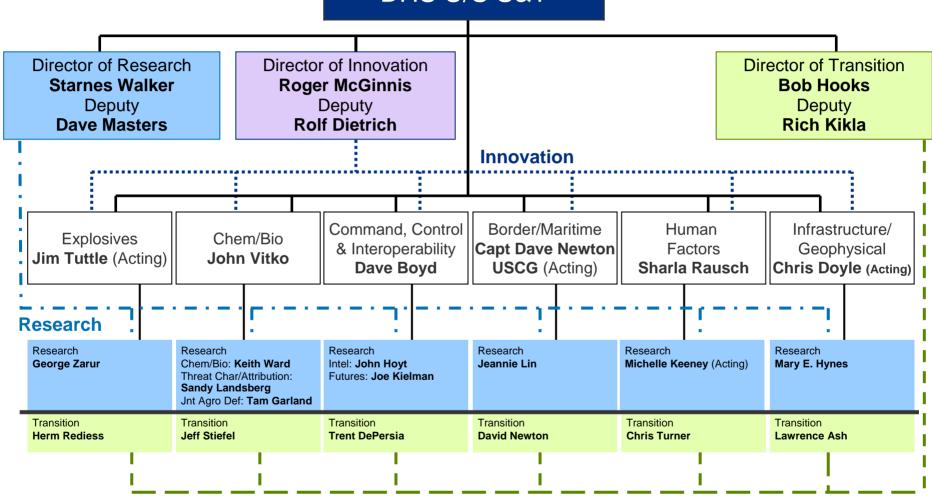
Customer Focused, Output Oriented
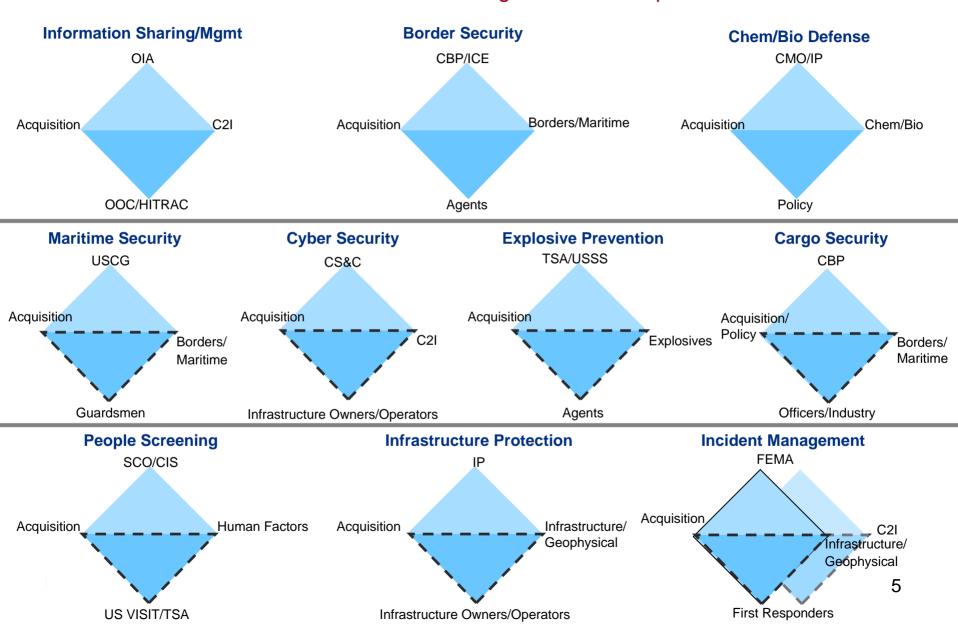
S&T Organization

DHS Requirements/Capability Capstone IPTs
DHS S&T Product – "Enabling Homeland Capabilities"

Information Sharing/Mgmt
- OIA
- Acquisition
- C2I
- OOC/HITRAC

Border Security
- CBP/ICE
- Acquisition
- Borders/Maritime
- Agents

Chem/Bio Defense
- CMO/IP
- Acquisition
- Chem/Bio
- Policy

Maritime Security
- USCG
- Acquisition
- Borders/Maritime
- Guardsmen

Cyber Security
- CS&C
- Acquisition
- C2I
- Infrastructure Owners/Operators

Explosive Prevention
- TSA/USSS
- Acquisition
- Explosives
- Agents

Cargo Security
- CBP
- Acquisition/Policy
- Borders/Maritime
- Officers/Industry

People Screening
- SCO/CIS
- Acquisition
- Human Factors
- US VISIT/TSA

Infrastructure Protection
- IP
- Acquisition
- Infrastructure/Geophysical
- Infrastructure Owners/Operators

Incident Management
- FEMA
- Acquisition
- C2I
- Infrastructure/Geophysical
- First Responders

5

National Center for Food Protection & Defense

- **Focus Areas**
- **Rapid response analysis assessing food ingredients and products from China,** in response to the contamination of animal/pet feed. Will include analysis of the foods that are most restricted in terms of available substitutes.

- **Consequence Modeling System: Modeling of food system contamination events** for vulnerability assessment, intervention/countermeasure evaluation and awareness. Has been expanded to support the NBACC 2008 bioterrorism risk assessment and the FDA/USDA food contamination event models.

- **Sensor for rapid detection of chemicals and toxins**, showing promise as a rapid screen for ricin in complex foods, e.g., fruit juice. Would provide a means of in-plant screening for potential intentional contamination.

Homeland Security

Future Alignment: Centers of Excellence

S&T DIVISIONS

Explosives	Chemical/Biological	Command, Control & Interoperability	Borders/Maritime	Human Factors	Infrastructure/ Geophysical
NEW *National Center for Explosives Detection, Mitigation & Response*	NATIONAL CENTER FOR **FOOD PROTECTION AND DEFENSE** *A HOMELAND SECURITY CENTER OF EXCELLENCE* **FAZD CENTER** NATIONAL CENTER FOR FOREIGN ANIMAL AND ZOONOTIC DISEASE DEFENSE **CAMRA** Center for Advancing Microbial Risk Assessment *Consolidated Chem/Bio Center*	**IDS-UACs** **RVACs** *Consolidated CCI Center*	**NEW** *National Center for Border Security & Immigration* **NEW** *National Center for Maritime, Island & Remote/Extreme Environment Security*	**START** ▶▶	**PACER** A HOMELAND SECURITY CENTER OF EXCELLENCE **NEW** *National Center for Natural Disasters, Coastal Infrastructure & Emergency Management*

◀── Operations & Analysis ──▶
Risk Sciences Branch & HSI Risk Determination

CREATE
HOMELAND SECURITY CENTER

DHS S&T Laboratories

Environmental Measurements Laboratory

National Biodefense Analysis and Countermeasures Center (NBACC)

Transportation Security Laboratory

Plum Island Animal Disease Center

… S&T has access to these four DHS S&T Labs and 10 DOE National Labs
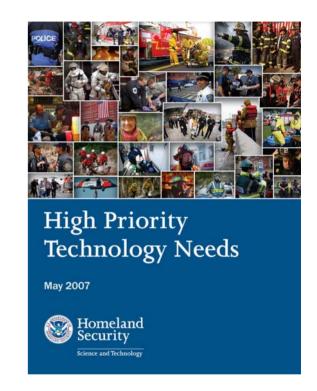
Homeland Security

High Priority Technology Needs

- 11 Capstone IPTs have identified 77 High Priority Technology Needs for DHS components and their customers

- Identified in new brochure and posted at www.hsarpabaa.com

- Baseline established for conducting an iterative, dynamic IPT process on an annual cycle aligned with DHS funding and acquisition processes

IPT Next Steps:

- Focus on delivering product to customers

- Detail proposed technology solutions

- Clarify deliverable and transition plans

- Develop Technology Transition Agreements to establish customer requirements and technical specifications

High Priority Technology Needs

May 2007

Homeland Security
Science and Technology

Customer Focused…Output Oriented

Chem/Bio Defense:
Representative Technology Needs

- Tools to detect and mitigate animal disease breakouts
- Policy net assessments to provide fresh perspectives on fundamental elements of the national biodefense strategy
- Improved tools for integrated CBRN Risk Assessment
- Incident characterization capability for response & restoration
- Improved Chem/Bio Forensic Analysis capability
- National-scale detection architectures and strategies to address outdoor, indoor (e.g., highly trafficked transportation hubs) and critical infrastructure
- Consequence assessments of attacks on chemical facilities and Chem/Bio attacks on other critical infrastructure
- Integrated CBRNE Sensor Reporting capability
- Handheld rapid biological and chemical detection systems
- Detection paradigms and systems for enhanced, emerging and novel biological threats

S&T Lead: Chem-Bio Division

Homeland Security

Infrastructure Protection: Representative Technology Needs

- Analytical tools to quantify interdependencies and cascading consequences as disruptions occur across critical infrastructure sectors
  (IP/Geophysical Division)

- Effective and affordable blast analysis and protection for critical infrastructure; improved understanding of blast failure mechanisms and protection measures for the most vital CI/KR
  (IP/Geophysical Division)

- Advanced, automated and affordable monitoring and surveillance technologies
  (C2I Division)

Homeland Security

Interoperability: Representative Technology Needs

- Development and evaluation of Internet Protocol (IP) enabled backbones

- Test and evaluation of emergent wireless broadband data systems

- Acceleration of development and testing of P25 IP-based interfaces

- Identification and development of message interface standards

- Transition of Land Mobile Radios communication architectures to cellular based architectures

- Evaluation of access technologies

- Development of the complementary test procedures

S&T Lead: C2I Division

12

Homeland Security Act of 2002

HSARPA will….

"Support basic and applied homeland Security research to promote *revolutionary* changes in technologies; advance the development, testing and evaluation, and deployment of critical homeland security technologies; and accelerate the prototyping and deployment of technologies that would address homeland security vulnerabilities."

EVERY TRULY GREAT ACCOMPLISHMENT IS AT FIRST IMPOSSIBLE!

(FORTUNE COOKIE)

Homeland Security

13
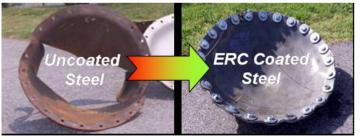
DHS S&T Innovation in the News

14
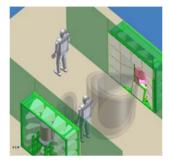
High Impact Technology Solutions
Improvised Explosive Devices Defeat

Masonry Walls

Explosive Resistant Coating

Uncoated Steel → *ERC Coated Steel*

Reactive & Shaping Walls
APE Project

Thickness variable as a function of distance and threat requirements.

- *Puffers* for explosives trace material detection on people, bags/parcels, and vehicles
- Walk-through/whole-body imaging (e.g., backscatter)
- Advanced Protection Explosive (APE): cancellation methods for explosive shock waves
- Drive-through imaging technology (x-ray, neutron)

Active Armor

Predict, Detect, Defeat and Destroy IED/VBIED at range (100 yards) to change the calculus of the bomber versus the defender

Homeland Security

15

Homeland Innovative Prototype Solutions
Future Attribute Screening Technology Mobile Module (FAST M2)

Systems
- Queue management
- Behavioral profiling
- Rapid risk assessment
- Screening methodologies

Operational Characteristics
- Discover screening methods for intent
- Privacy protection for all participants
- Simple to operate and use

Functions
- Identity verification
- Attribute measurement
- Risk determination
- Behavior focused screening

Homeland Security

Homeland Innovative Prototypical Solutions
Levee Strengthening and Rapid Repair

Pre-emptive mapping of weak levees

Pre-Flood Deployment of Protective And Rapid Repair Supplies to Problem Locations

Drop-in structures lofted by aircraft

Float-in structure guided by cables

Explosively Emplaced Support Structures

Roll-out protective coverings such as articulated concrete mats

Homeland Security

Homeland Innovative Prototypical Solutions
Levee Strengthening and Rapid Repair

Click on image to start video

Homeland Security

Doing Business with DHS S&T

Broad Agency Announcements (BAAs)

Released May 1

- IED and Vehicle-Borne Explosive Device Defeat

- Document validator

- Biometric detector

- Home Made Explosives Detection System Development

- Emerging Counter-MANPADS Technologies Assessment

For more about BAAs, visit www.FedBizOpps.gov and www.hsarpabaa.com

Doing Business with DHS S&T *cont'd*

Additional Open BAAs
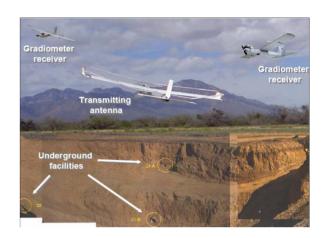
- Tunnel Detection Technologies

- SAFE Container (SAFECON) – detect and identify WMD, explosives and contraband cargo and detect humans in shipping containers

- Future Attribute Screening Technology (FAST) Demonstration Laboratory – rapid screening of people and their credentials and belongings

- CHLOE - High Altitude Endurance UAV System-Based Counter-MANPADS Technology Assessment

*Visit **www.FedBizOpps.gov** and **www.hsarpabaa.com***

Active SBIR Program for Small Businesses

- For FY 2007 release: Two solicitations that address multiple technical requirements of the DHS community

*Visit **www.FedBizOpps.gov** and **www.sbir.dhs.gov***

DHS S&T Conference Update

Coming Up

- International conference, London, December 3-5, 2007

- Conference with first responder focus, southern California, January 2008

- Stakeholders Conference, Washington, DC, May 2008

- International conference, Pacific Rim, late 2008

Homeland Security

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FROM SCIENCE...SECURITY

Homeland Security

Explosives

Chemical/Biological

Command, Control, & Interoperability

Borders/Maritime

Human Factors

Infrastructure/Geophysical

FROM TECHNOLOGY...TRUST

23

Back-Up slides
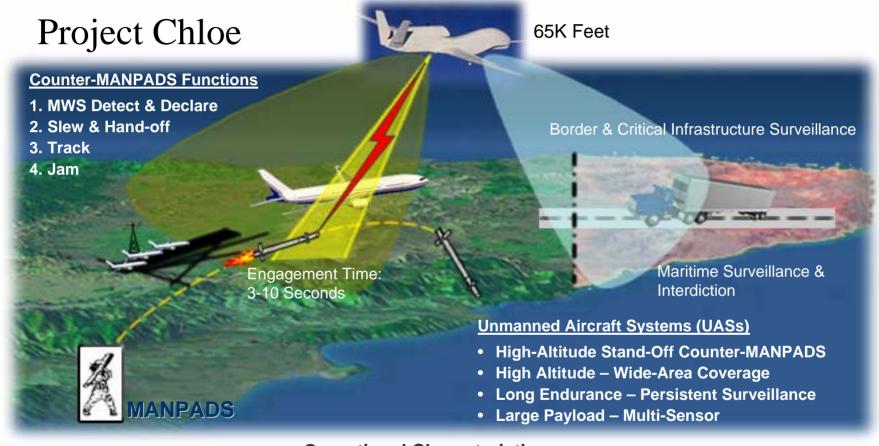
High Impact Technology Solutions
Cell-All Ubiquitous Chem/Bio Detect

Homeland Innovative Prototypical Solutions
Counter-MANPADS/Persistent Surveillance

Project Chloe

65K Feet

Counter-MANPADS Functions

1. MWS Detect & Declare
2. Slew & Hand-off
3. Track
4. Jam

Border & Critical Infrastructure Surveillance

Engagement Time:
3-10 Seconds

Maritime Surveillance &
Interdiction

MANPADS

Unmanned Aircraft Systems (UASs)

- **High-Altitude Stand-Off Counter-MANPADS**
- **High Altitude – Wide-Area Coverage**
- **Long Endurance – Persistent Surveillance**
- **Large Payload – Multi-Sensor**

Operational Characteristics

- Real-time sensor fusion/dissemination
- Multi-user / border surveillance requirements
- Commercial Aircraft MANPADS protection
- Automatic target detection/recognition
- Persistence (24/7, all-weather coverage)

Homeland
Security

DHS S&T Directorate

HIPS and HITS

Homeland Innovative Prototypical Solutions (HIPS) are designed to deliver *prototype-level demonstrations* of game-changing technologies in two to five years. Projects are moderate to high risk, with high payoff.

High Impact Technology Solutions (HITS) are designed to provide *proof-of-concept* answers within one to three years that could result in high-payoff technology breakthroughs. While these projects are at considerable risk for failure, they offer the potential for significant gains in capability.

Homeland Security

Homeland Innovative Prototypical Solutions (HIPS)

Explosives	Chem/Bio	Command, Control & Interoperability	Borders/ Maritime	Human Factors	Infrastructure/ Geophysical
Project Chloe- High altitude aerial platform existing above civil aviation Counter-MANPADS **SENSIT** – System to identify numerous liquids in baggage **IED Defeat / APE VBIED Defeat** – Detection/prevention and mitigation technologies to counter IEDs		**SCOPE** (Scalable Common Operational Picture Experiment) – Leverages Global Observer JCTD	**Next Generation Patrol Craft** Lightweight, composite material with high-speed hull **SAFECON –** 90 second container screening device	**FAST M2** (Future Attribute Screening Technology Mobile Module) – Relocatable Lab capable of testing for behavioral/ physiological cues of "hostile intent" Double or triple wide trailer tested at various sites around the country	**Resilient Electric Grid** – System that will prevent cascading effects of power surge on electrical grids **Levee Strengthening and Rapid Repair -** rapidly stop a breach in a levee **Storm Surge and Hurricane Mitigation**

High Impact Technology Solutions (HITS)

Explosives	Chem/Bio	Command, Control & Interoperability	Borders/ Maritime	Human Factors	Infrastructure/ Geophysical
	Real Time Bio Detection and Identify **Cell-All -** Ubiquitous Chem/Bio/agent detector	**First Net -** First Responder Reliable Relay Link	**Tunnel Detect** – Ability to detect, identify, and confirm illegal and clandestine underground border structures and activities	**Document Validator** –High proficiency scanner that can identity fraudulent docs Leverage USSS system **Biometric Detector** – High proficiency small biometric scanner	**Wide Area Surveillance/ Change Detection for Critical Infrastructure** **Resilient Tunnel**– Tunnel Protection/Blast Mitigation

Detecting, Locating, and Discriminating Impulsive Airburst as HE/CB Event Using Unattended Acoustic Sensors

US Army RDECOM-ARDEC

By: Mr. Sachi Desai, Dr. Myron Hohil, Mr. Amir Morcos, and Mr. Brian Peltzer

Relevance to Homeland Security

- Providing a low cost solution for defense and enhanced situational awareness against Chem/Bio attacks via airburst disseminations.

- Protecting vital interest against aerosol attacks via airburst explosions.

- Utilizing acoustic sensors to cue more expensive sensing systems.

Key Objective of Technology

- Determining if an explosive event contains only High Explosive material or plausible Chemical/Biological agent on the battlefield.

- Providing emergency workers greater response time using a stand alone acoustic sensor.

- Giving greater situational awareness to first responders.

Topic Content

- Current Readiness
- Key Challenges to Implementation
- Benefits of the Technology
- Conclusion
- Future Work

Maturity and Readiness Level
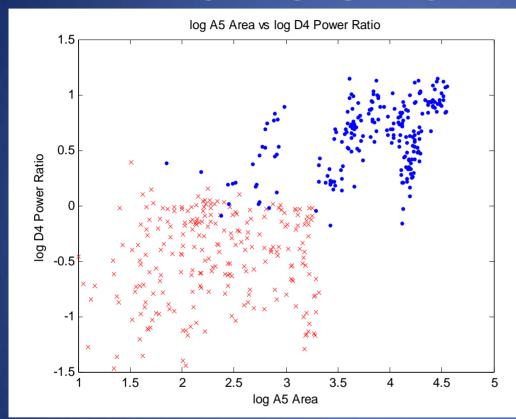
- Portable Area Warning Surveillance System (PAWSS).
  - 1yr Limited Objective Experiment (LOE).
  - Focused on the utility of cascading detection methodologies.
- LOE Outcomes.
  - Demonstration of capabilities within simulated battlefield environments of layered wide area cascading detection.
- Cueing System.
  - Develop a cueing mechanism for expensive sensing technologies like JSLSCAD.

Barriers To Readiness

log A5 Area vs log D4 Power Ratio
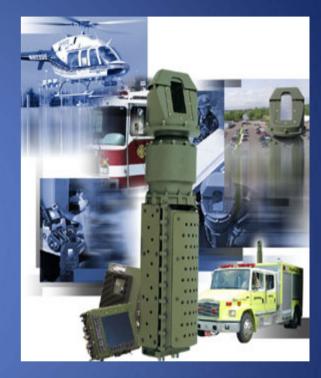
Picture from GDATP website

Merging the acoustic algorithms with more complex but distance/energy limited sensing technologies to provide notification and cueing.

Benefits to Homeland

The utilization of acoustics for cueing and notifying more expensive sensing chem/bio sensing technologies will increase situational awareness for first responders reducing exposure and expedite rescues.

Courtesy of www.iir.com

Courtesy of www.republicoft.com

Conclusions/Recommendations

- Features extracted facilitate robust classification.
  - Reliable discrimination of CB rounds, 98.3% or greater of single volley events.
- The features this algorithm is based on utilize only acoustic properties.
  - Degradation due to signal attenuation and distortion is nullified and exceeds 3km in range propagation.
- The acoustic signature propagated from the event provide approximate location to the event and if event was CB dissemination event.
  - Isolating the details of higher oscillatory components.
- Real time verification at PAWSS LOE of CBRN Discrimination Program Implemented in C++.
  - Airburst discrimination in real time for all variants was 100%.
- Implementing the algorithms with an array provide added situational awareness for first responders in advent of potential CB attacks.
  - Utilizing TDOA algorithms and acoustic propagation properties to provide cueing capabilities to more expensive limited sensing technologies.
- Future Considerations.
  - C4 initiated releases and providing cueing information to a JSLSCAD in September 2007.

Keys to Success for Emergency Preparedness and Disaster Response

Kris Eide

Director

Homeland Security and Emergency Management

National Preparedness Goal

To achieve and sustain target levels of capability to

- **Prevent**
- **Protect against**
- **Respond to**
- **Recover from**

major events in order to minimize the impact on lives, property and the economy

HSEM
Homeland Security and Emergency Management

Seven National Priorities

Overarching

1. Implement National Incident Management System and National Response Plan (soon to be Framework)
2. Expand Regional Collaboration
3. Implement the National Infrastructure Protection Plan

National Priorities (cont.)

Capability Specific

4. Information Sharing and Collaboration

5. Interoperable Communication

6. CBRNE Detection and Response

7. Medical Surge and Mass Prophylaxis

HSEM
Homeland Security and Emergency Management

Capabilities Based Planning

- Know your hazards, risks, threats
- Know the target capability
- Assess your current capability
- Analyze the gaps
- Prioritize efforts to close the gaps

HSEM
Homeland Security and Emergency Management

Keys to Preparedness & Response

- All Disasters Are Local
- Bottom up approach
  - Local hazard/risk analysis
  - Local Capability Assessment
  - Regional Assessment
  - Statewide Assessment

HSEM
Homeland Security and Emergency Management

Building Capabilities

- Solution is not always technological
  - Governance
  - Systems
  - Relationships
  - Partnerships

HSEM
Homeland Security and Emergency Management

Technological Solutions

- Must fit the mission

- Must be scalable

- Must be maintained

HSEM
Homeland Security and Emergency Management

Conclusions

- Preparedness is local but within a national framework
- We should all have a common approach to develop capabilities
- Working toward the priorities in the near term achieves preparedness for the longer term
- Technology is one "tool in our toolbox"

HSEM
Homeland Security and Emergency Management

Focus on <u>Phase III</u>

(Defense Technology Transition & Commercialization)

Partnering with the Department of Defense for

Developing Medical & BioDefense Technologies

Technology Licensing, CRADAs, SBIR/STTR & Transition Assistance programs

Ray Friesenhahn
SBIR & Technology Transition Manager
2007 Heartland Security Conference

TechLink is an Authorized
U.S. Department of Defense
Partnership Intermediary per
Authority 15 U.S.C. 3715

TechLink

- **Established 1996 to support NASA regional Technology Transfer**

- **Defense TechLink began FY99 to support national DoD Technology Transfer requirements**

- **Currently the primary DoD-wide "Partnership Intermediary" for Technology Transfer**

- **Under OSD: DUSD (AS&C) OTT**

- **Recognized as one of 9 "exemplary models" nationwide of federal technology transfer (U.S. Dept. of Commerce, 2003)**

TechLink

Defense TechLink Mission:

Link DoD labs with companies for development and commercialization of new technology

Purpose:
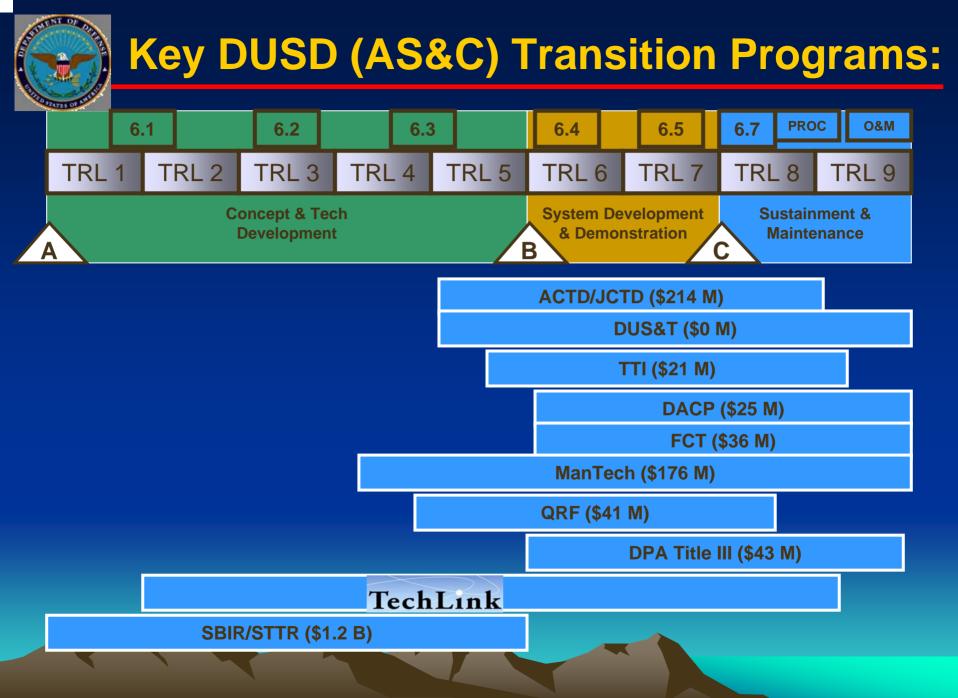
- ❑ **Help DoD transfer and acquire new technology**
- ❑ **Increase the competitiveness of U.S. industry**

Key Activities:
National:
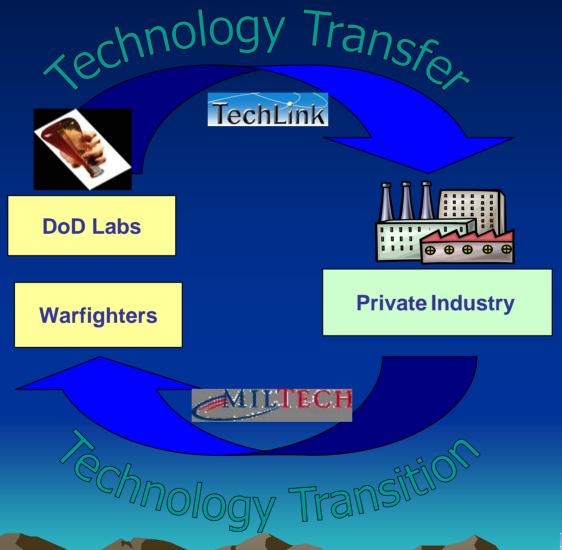
o Licensing of DoD Technologies for commercial and Dual Use applications
Regional:
o Establish Joint R&D projects between DoD and companies for new technology development (CRADAs)
o Help DoD in acquisition of new technologies via SBIR, other agreements focused on Technology Transition

TechLink

Key DUSD (AS&C) Transition Programs:

| 6.1 | 6.2 | 6.3 | 6.4 | 6.5 | 6.7 | PROC | O&M |

| TRL 1 | TRL 2 | TRL 3 | TRL 4 | TRL 5 | TRL 6 | TRL 7 | TRL 8 | TRL 9 |

Concept & Tech Development

System Development & Demonstration

Sustainment & Maintenance

A   B   C

ACTD/JCTD ($214 M)

DUS&T ($0 M)

TTI ($21 M)

DACP ($25 M)

FCT ($36 M)

ManTech ($176 M)

QRF ($41 M)

DPA Title III ($43 M)

TechLink

SBIR/STTR ($1.2 B)

TechLink's Roles for DoD:

Finding & Acquiring New Technology

DoD Technology Licensing Opportunities:

- **Technology already developed for DoD needs, dual-use**
  - **Available for small fraction of development cost**
- **Can significantly enhance your own technology**
- **Can increase your perceived credibility**
- **Can build your connections with funding agencies**
- **May even serve as basis for other funding opportunities**

TechLink can help!

Authorized U.S. Department of Defense Partnership
Intermediary per Authority 15 U.S.C. 3715

TechLink

Leveraging Your Resources

Advantages of a CRADA (Cooperative R&D Agreement):

- Tie into significant R&D capability at little or no cost

- Utilize specific R&D capability available nowhere else

- Increase your perceived credibility based on partnership

- Become familiar with DoD customer's needs, culture

- Agency personnel become familiar with your capabilities for potential advantage

- Often opens doors for other funding opportunities

TechLink can help!

Authorized U.S. Department of Defense Partnership
Intermediary per Authority 15 U.S.C. 3715

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Licensing Example: Portable Medical Sterilizer

- **Developed by Army Natick Soldier Center & Army Institute of Surgical Research**

  - **Uses small qty of chemical powder and water to produce chlorine dioxide**

  - **Gas scrubber allows indoor use**

  - **No external power required**

- **Licensed to Primus Sterilizer (Omaha, NE) and ICA TriNova (Newman, GA)**

- **Companies jointly developing and testing for regulatory approval**

- **Systems to be used for military surgeons and international disaster relief efforts**

TechLink

Licensing Example: *Medical Info Management*

- **Battlefield Medical Information System-Tactical (BMIS-T) developed by Army Telemedicine and Advanced Technology and Research Center (TATRC) - over 5,000 units in military use**

- **Software on palm computer, scans Personal Information Carrier (electronic dogtag) for medical history**

- **Rapid entry of injury info, receives diagnosis and recommendations for initial treatment, transmittal for follow-up care**

- **Licensees include Doctor's Business Services (DBS); GlobeCom 21, Inc.; LogicaCMG; Vista Partners; and CHI Systems**

TechLink
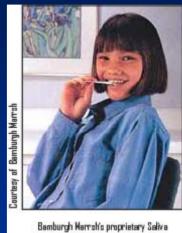
Licensing Example: TB, Anthrax Tests

- **Naval Institute of Dental and Biomedical Research (NIDBR) developed two separate saliva-based tests:**

    - **Rapid (<20 min.) saliva-based tuberculosis diagnosis**

    - **Anthrax immunization status test strip - color change indicates status in minutes**

- **Both licensed by Bamburgh Marrsh LLC (Vancouver, WA)**

- **Company also participating in CRADA with Naval Medical Research Center to optimize the test with the Bamburgh Marrsh sampler and to gather additional data for rapid 510(k) FDA clearance.**

Courtesy of Bamburgh Marrsh

Bamburgh Marrsh's proprietary Saliva Sampler in use.

Courtesy of Bamburgh Marrsh

Bamburgh Marrsh's new VerOFy™ diagnostic test system.

TechLink

Part of TechLink's Mission for DoD:

Help DoD in finding and acquiring critical new technologies to support the needs of the <u>Warfighter</u>

- ❑ May be "Dual Use" applications of DoD-developed technologies

- ❑ Important role of DoD SBIR Program to acquire specified new technologies or capabilities from innovative small technology firms.

- ❑ SBIR assistance focused on capable companies demonstrating intent to follow through to Transition (as qualified DoD contractors/subcontractors)

- ❑ Help in expanding the U.S. small business technology base

TechLink

Overview: SBIR/STTR

o Small Business Innovation Research
   Small Business Technology Transfer

o Federally mandated programs (since 1982/1992) for agency funding of small business (<500 empl.) R&D to develop new commercial products/services

o FY07 Budgets:

   o SBIR: >$2 Billion

      o 2.5% of extramural R/R&D for agencies >$100 M

   o STTR: ~$200 Million

      o 0.3% of extramural R/R&D for agencies >$1 B
      o Doubled in FY04 from 0.15%

SBIR/STTR Overview (cont.):

3-Phase Program:

o **Phase I: Feasibility Study**
- o "Typically" 6-month, $70K - $100K

o **Phase II: Proof of Principal/Prototype**
- o "Typically" 2-year, up to $750K (or more)

o **Phase III: Commercialization (or "Transition" to DoD procurement programs)**
- o No SBIR/STTR funding
- o May be government procurement
- o Possible Phase II "Enhancement" to get there

TechLink

SBIR/STTR Summary Info:

	SBIR	STTR
Total Ann. Amt.	~$2 Billion	~$200 Million
Agencies	11	5 (DoD, DOE, NIH, NASA, NSF)
Phase I (~15% win, higher for STTR)	Typically $75K 6 months	Typically $100K 12 months
Phase II (~40% win)	Typically $750K 24 months	Now $750K 24 months
(University) Subcontracts Phase I: Phase II:	Allows up to 1/3 Allows up to 1/2	Requires 30 – 60% Requires 30 – 60%

TechLink

Key Requirements for SBIR Success:

o **Innovation**
- o New Product or Technology
- o New Application of Existing Technology

o **Research**
- o Research of the Feasibility of the Project
- o Not Market Research
- o Not Strictly Product Development

o **Commercial Applications**
- o Societal Need and Commercial Potential
- o Specific Agency Need and "Dual Use"

TechLink

TechLink's DoD SBIR Assistance:

(For Qualified Companies in Greater NW Region)

- Specific SBIR Assistance:
  - Facilitate discussions with TPOCs, other DoD contacts
  - Guidance through process, technical relevancy
  - Travel support to visit DoD labs, Primes
  - Expert outside proposal review, graphics, commercialization planning
  - Incentives for timely drafts, submission
  - Additional partnering for improved project development
- Technology Partnerships with DoD Labs
  - Add major value to company's R&D efforts
  - Improve understanding of DoD needs
  - Often lead to contracts, other opportunities

TechLink

Transition: *Critical Focus for DoD SBIR*

Goal is to convince the <u>customer</u> (DoD reviewers) that you have a clearly defined pathway to their end-product:

- Credible R&D Capability
- Strategic Partnerships
- Alliances with appropriate Primes
- Thorough familiarity with customer's need and product use

Federal law permits sole source contracts for technology developed under SBIR

Transition: Bridging the Gap from R&D to Systems Applications

Primes $

TechLink

Partnerships $

LABORATORY $
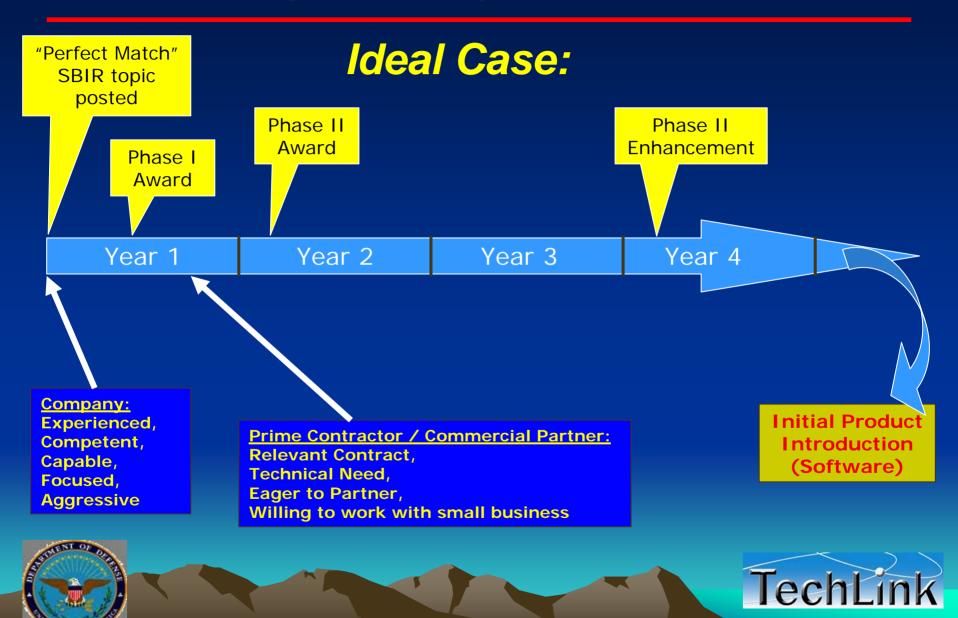
Keys to DoD SBIR Success:

Build long-term relationships with appropriate DoD labs and organizations

- o *Plan to be in for the long haul*

- o *Seek, build mutually beneficial relationships*
    - o *CRADAs, Licenses, other Partnerships*

- o *Emphasize Service, Value to DoD and the Warfighter*
    - o *Other funding opportunities may arise*
        - o *Potential "slice of the pie," vs. SBIR "seed money"*

- o *Plan for "Dual-Use" Success!*

Timeline: SBIR to Commercialization

Ideal Case:

"Perfect Match" SBIR topic posted

Phase I Award

Phase II Award

Phase II Enhancement

Year 1	Year 2	Year 3	Year 4

Company:
Experienced, Competent, Capable, Focused, Aggressive

Prime Contractor / Commercial Partner:
Relevant Contract,
Technical Need,
Eager to Partner,
Willing to work with small business

Initial Product Introduction (Software)

TechLink

Client Example: Visual Learning Systems, Inc. Transition Success: Feature Analyst™ Software

Technology: Software for automated feature extraction in hyperspectral or panchromatic images. Learning algorithms are orders of magnitude faster than manual digitizing, also easy to train.

- Developed under multiple SBIRs:
  - 3 NASA SBIR awards, 3 NSF
  - Army TEC Ph. I & II, NAVAIR Ph. I & II
- CRADAs & Partnerships with Gov't:
  - Army TEC & NUWC CRADAs
  - NASA TCA
  - NIMA & NRO partnerships
- Partnered with Primes:
  - ESRI, Leica, BAE, Intergraph
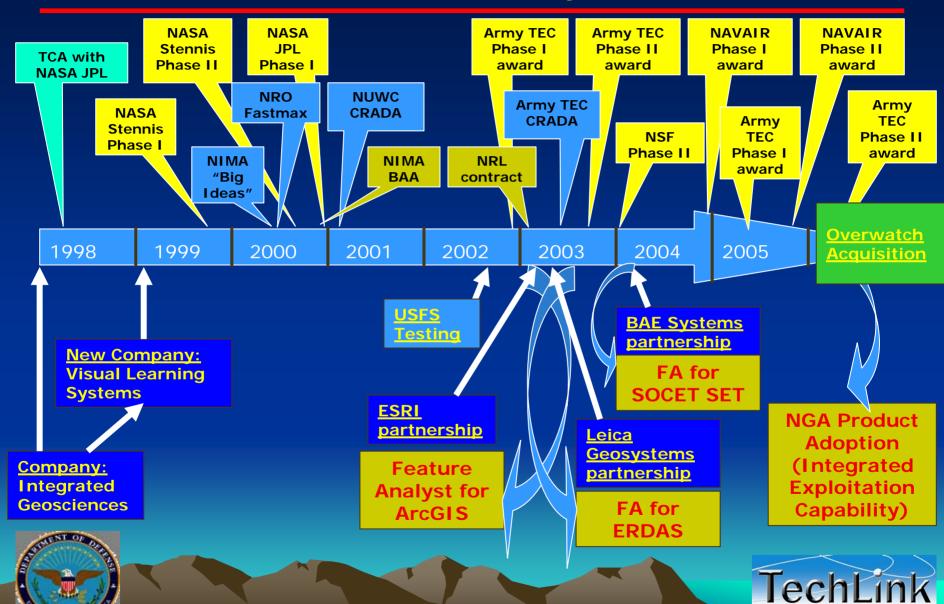
One Click Feature Extraction using Feature Analyst

Chosen by NGA for deployment across all NGA's Integrated Exploitation Capability (IEC) workstations – Now Dual-Use (Commercial & Military) Success!

TechLink

Client Example: TenXsys, Inc. (Eagle, ID)
Medical Physiological Monitoring

SMART (Sensor Monitoring and Relay Transmission), designed to improve amputee monitoring during rehabilitation, provide health and motion monitoring sensor and analysis system for military personnel with prosthetic devices.

- Funding under OSD SBIR from U.S. Army Research Institute of Environmental Medicine (USARIEM) in Medical Research and Materiel Command.

- Previous NASA and USDA SBIR awards helped co. develop advanced wireless networking capability, methods for powering sensors and data transmitters using motion of animals being tracked and monitored.
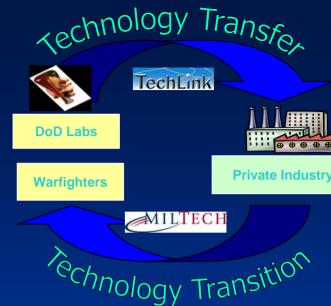
TechLink assistance for travel, networking led to In-Q-Tel priority investment ($ multi-million) for applications to Defense HUMINT (Human Intelligence)

TechLink

- MilTech is a partnership between TechLink and MMEC

- Mission: Transition innovative technology to the US warfighter faster, better, and more cost effectively

- Activities
  - Product design, manufacturing and management assistance
  - Sustainability/Commercialization for licensees

- Benefits
  - Improve DoD's return on R&D investment
  - Critical technology into soldier use quickly and reliably

HemCon Bandage

MilTech Assistance

- Customized equipment operations manual and quality system
- Major yield improvement
- Financial sustainability

Instantly stops bleeding, saves lives, reduces post-trauma injuries/amputations

Field Portable Medical Sterilization

MilTech Assistance

- Component integration
- Product ruggedization, design for life-cycle-cost reduction
- Product testing

Improved sterilization of deployed medical equipment

Client Example: Scientific Materials Corp.
Transition Success: Monoblock Laser (STORM)

Technology: Manufacturing method for eye-safe rugged solid-state microlaser developed at Army CECOM under ManTech (2000 – 2001)

- Company participant in ManTech project
- Enabling materials developed under SBIRs

- License to SMC completed 2003
    - World-class laser/optoelectronic crystal production capabilities via multiple SBIRs

- TechLink/MilTech assisted with monoblock production improvement

- Used in Small Tactical Optical Rifle Mounted (STORM) Micro-Laser Rangefinder (MLRF)
    - Thousands now deployed

- SMC bought by FLIR for $13 M
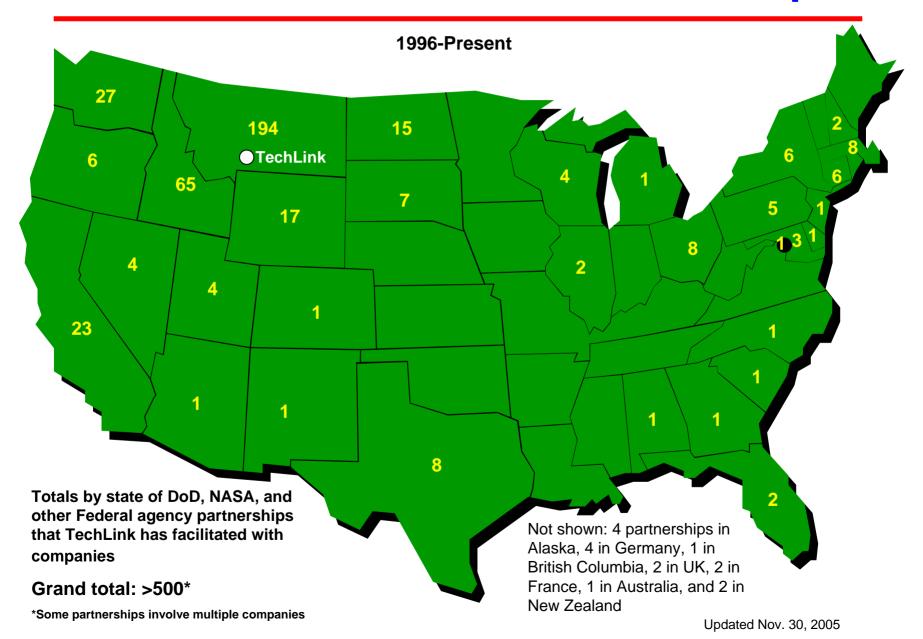
TechLink Results
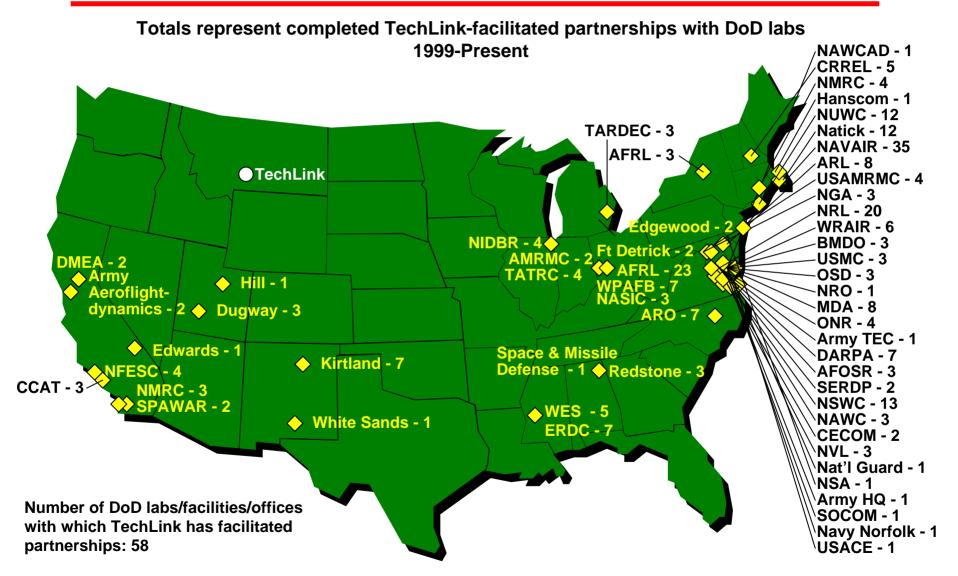
- **Over 500 partnerships between companies and DoD, NASA, and other federal agencies**

- **Assisted regional companies in securing over $85 Million in new R&D funding**

- **Includes 170 SBIR/STTR Phase I, II, III awards worth > $66 million**

- **Over 30% of all DoD technology licensing nationwide in FY03, FY04, FY05, FY06**

Recognized by the US Department of Commerce, Office of Technology Policy, as one of nine exemplary models nationwide of federal technology transfer

Distribution of TechLink Partnerships

1996-Present

Totals by state of DoD, NASA, and other Federal agency partnerships that TechLink has facilitated with companies

Grand total: >500*

*Some partnerships involve multiple companies

Not shown: 4 partnerships in Alaska, 4 in Germany, 1 in British Columbia, 2 in UK, 2 in France, 1 in Australia, and 2 in New Zealand

Updated Nov. 30, 2005

DoD Lab Partnerships

Totals represent completed TechLink-facilitated partnerships with DoD labs 1999-Present

TechLink

TARDEC - 3
AFRL - 3

Edgewood - 2

NIDBR - 4
AMRMC - 2
TATRC - 4

Ft Detrick - 2
AFRL - 23
WPAFB - 7
NASIC - 3

ARO - 7

DMEA - 2
Army Aeroflight-dynamics - 2

Hill - 1

Dugway - 3

Edwards - 1

Kirtland - 7

CCAT - 3

NFESC - 4
NMRC - 3
SPAWAR - 2

White Sands - 1

Space & Missile Defense - 1

Redstone - 3

WES - 5
ERDC - 7

NAWCAD - 1
CRREL - 5
NMRC - 4
Hanscom - 1
NUWC - 12
Natick - 12
NAVAIR - 35
ARL - 8
USAMRMC - 4
NGA - 3
NRL - 20
WRAIR - 6
BMDO - 3
USMC - 3
OSD - 3
NRO - 1
MDA - 8
ONR - 4
Army TEC - 1
DARPA - 7
AFOSR - 3
SERDP - 2
NSWC - 13
NAWC - 3
CECOM - 2
NVL - 3
Nat'l Guard - 1
NSA - 1
Army HQ - 1
SOCOM - 1
Navy Norfolk - 1
USACE - 1

Number of DoD labs/facilities/offices with which TechLink has facilitated partnerships: 58

Updated Nov. 30, 2005

For Further Information:

For MN SBIR/STTR: Ms. Betsy Lulfs, MN DEED:
www.deed.state.mn.us/sbir

SBIR news, information and topic search engine:
www.zyn.com/sbir

Information on TechLink's DoD SBIR assistance:
www.techlinkcenter.org/sbir

TechLink's DoD licensing assistance, MilTech:
www.techlinkcenter.org

Miniature Aerial Vehicles for Traffic Management and Transportation Infrastructure Security

Demoz Gebre-Egziabher

(gebre@aem.umn.edu)

Department of Aerospace Engineering & Mechanics

University of Minnesota, Twin Cities

Minneapolis, MN

UNIVERSITY OF MINNESOTA

Aerospace Engineering and Mechanics

A department of the Institute of Technology at the University of Minnesota

- Strives for excellence: in education, outreach, and pioneering research.
- Award-winning, internationally-recognized faculty with expertise in three primary areas:
  Aerospace Systems, Fluid Mechanics, and Solid Mechanics.

- 17 faculty

- 300 undergraduates and 85 graduate students

- Institute of Technology has 4,445 undergraduates, 2,450 graduate students, and about 400 faculty across 12 departments.
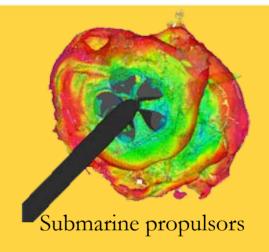
Aerospace Engineering and Mechanics

A department of the Institute of Technology at the University of Minnesota

Inlet for Mach 10 Scramjet

Submarine propulsors

Visualizing complex structure in turbulent boundary layers
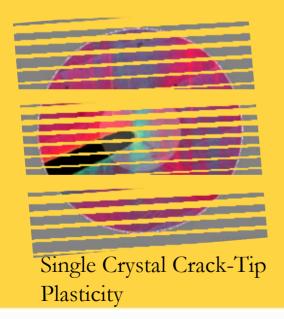
Water exposed to airflow at Mach 3.0

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Driven to Discover

Aerospace Engineering and Mechanics
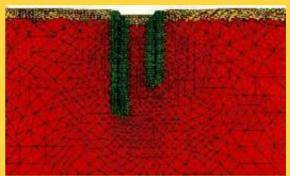
A department of the Institute of Technology at the University of Minnesota
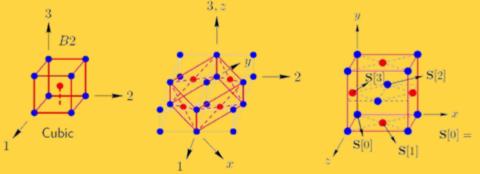
Exploring the Bonded Punch problem

The Quasicontinuum Method

Single Crystal Crack-Tip Plasticity
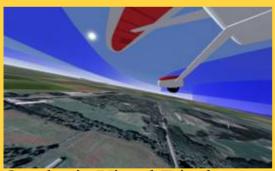
Martensitic solid-to-solid transformations

Aerospace Engineering and Mechanics

A department of the Institute of Technology at the University of Minnesota

High Integrity Navigation

Advanced UAV flight systems

Synthetic Visual Displays

Supercavitation experimental research

UNIVERSITY OF MINNESOTA
Driven to Discover

UAV/RPV Research at U of MN

- Project: "Remotely Piloted Aerial Vehicles for Traffic Management and Infrastructure Security Applications"

- Research Sponsors:
  - Intelligent Transportation Systems (ITS) Institute, University of Minnesota.
  - Minnesota Department of Transportation (MnDOT).
  - SRF Consulting.

- Project Objectives:
  - Explore ITS capabilities enabled by Uninhabited Aerial Vehicles (UAV) and Remotely Piloted Vehicles (RPV).
  - Develop "turn-key" sensors and systems which enable their use ITS applications.
    - **"Dual-use Technologies"**: Relevant to homeland security applications.
  - Explore regulatory issues associated with operating them for these ITS applications.

ITS Applications: Classification

- Potential missions for UAV/RPV in ITS applications can be divided into two broad groups:
  - Strategic
    - Operations where the aerial vehicle is expected to traverse or cover a large geographical area.
    - Operation *mostly* in response to pre-planned events.
    - Vehicle must have some level of autonomy.
  - Tactical
    - Operations in and around a small geographical area.
    - Operation can be in response to planned or unplanned events.
    - Tele-operation of the vehicle is possible.
- Our focus is on tactical operations.

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Example of Tactical Operations

- Recent examples: Hurricane Katrina recovery effort
  - 5 *Silver Fox* UAVs used during hurricane Katrina search rescue operation.
  - Remotely piloted helicopters used for structural inspection

- Planned future uses:
  - Evacuation coordination
  - Nodes for communication & navigation networks
  - Delivery of emergency supplies.
  - Intelligent Transportation Systems (ITS) sensor platforms (e.g. Utah Highway Patrol *Bergen Observer* used for accident scene management)

© 2005 National Science Foundation
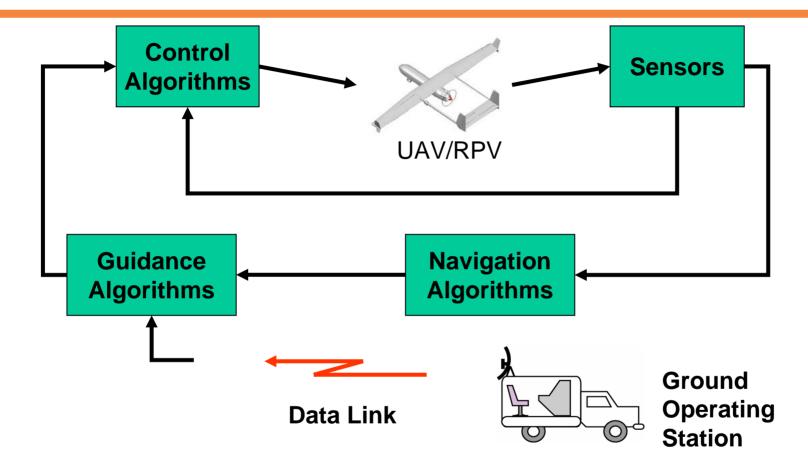
Silver Fox

Applications, Regulations & Technology

- The use of RPV in support of tactical ITS or law enforcement operations is practical and possible in the current regulatory environment.

- Regulatory issues associated with operation in the National Airspace System make strategic UAV/RPV operations much more challenging.

- Many of the *off-the-shelf* vehicle guidance, navigation and control solutions MAY NOT have the performance required to support these applications:
  - Attitude determination systems.
  - Navigation.

Guidance Navigation & Control
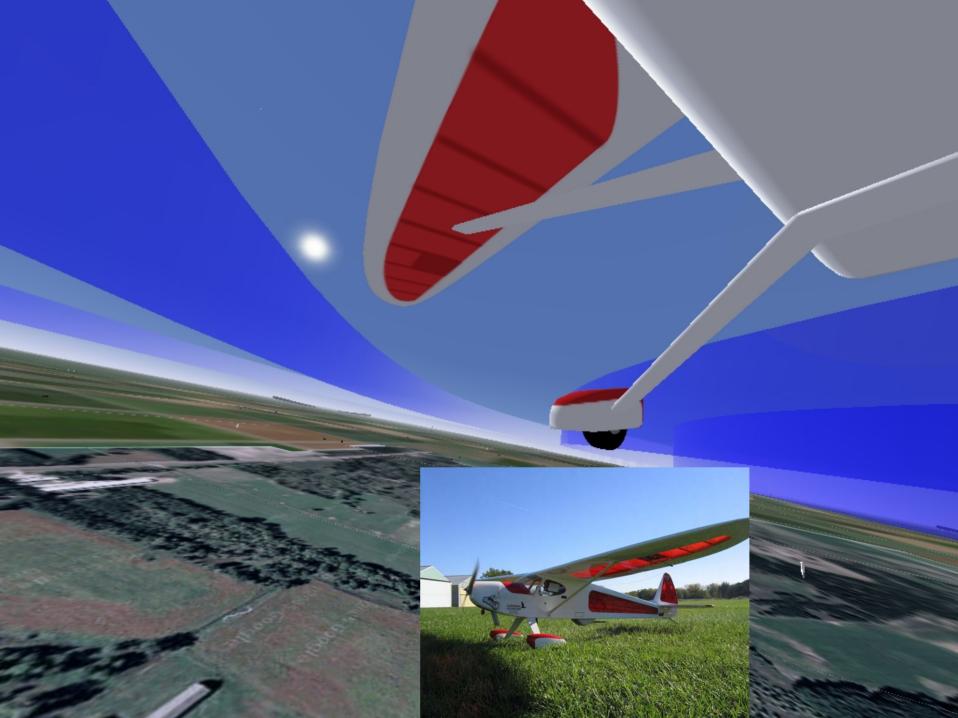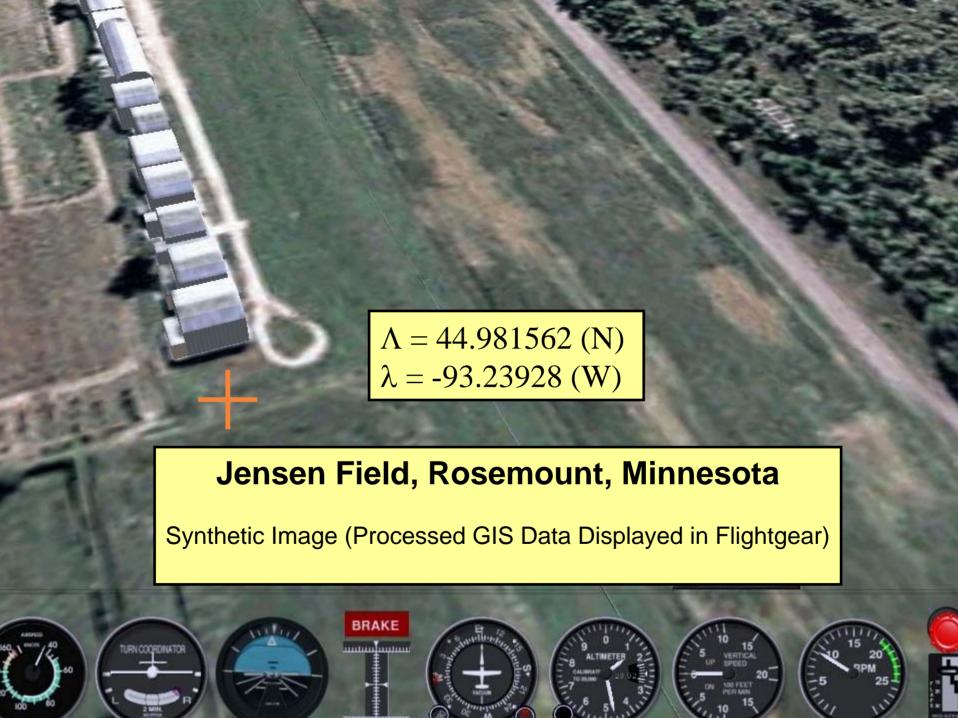
- **Currently, our UAV/RPV work does NOT involve sensor payload design.**
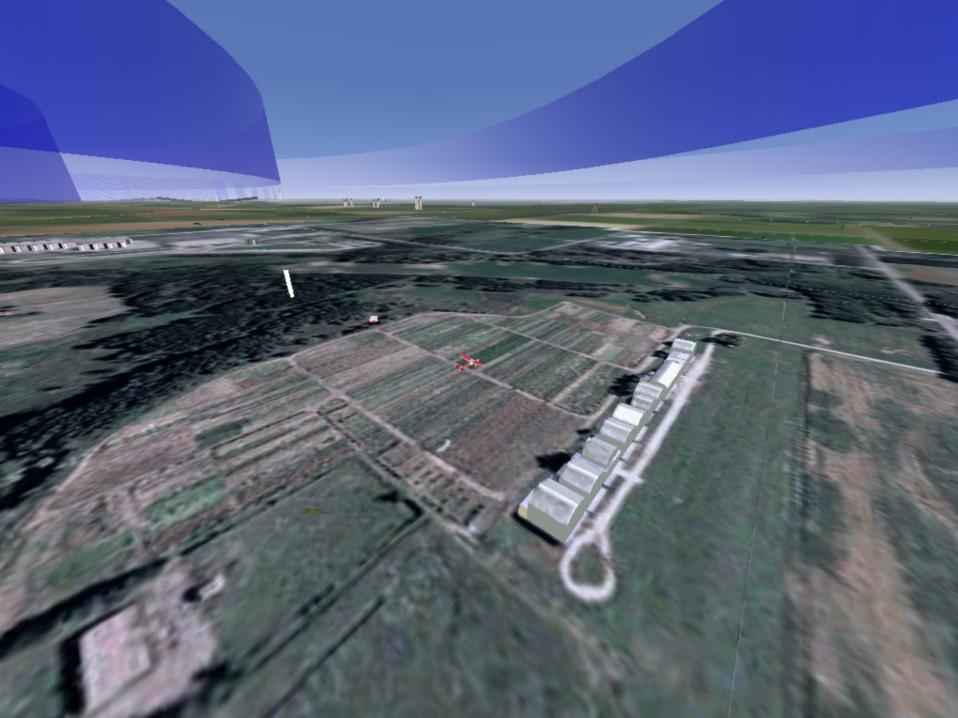
VIDEO
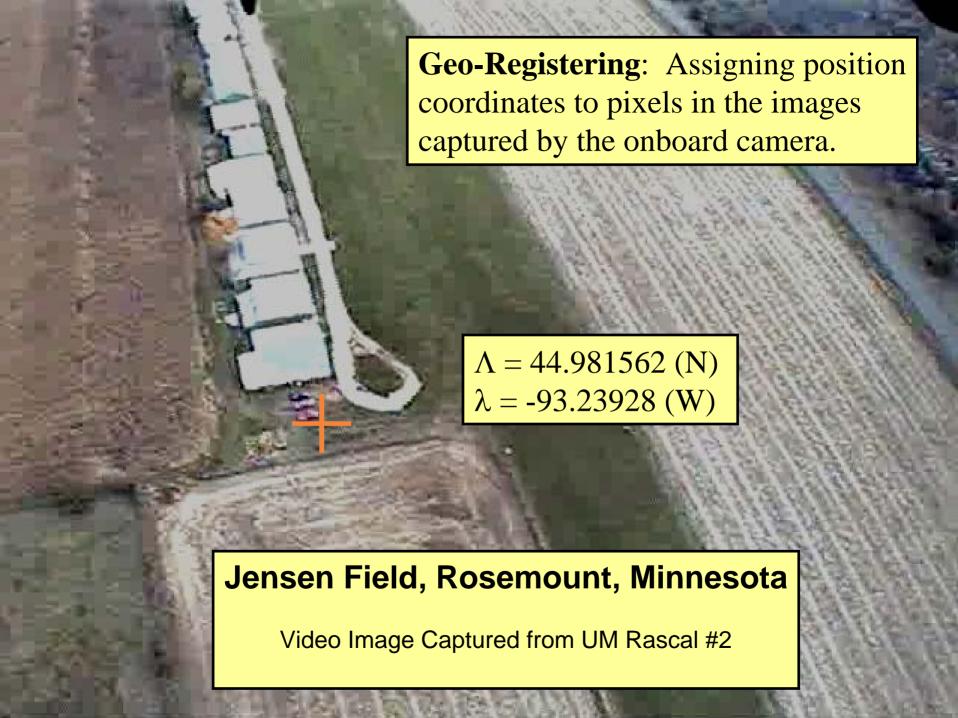
http://www.aem.umn.edu/people/gebre/UAV2/Big/chapt1-divx6.avi

$\Lambda = 44.981562$ (N)
$\lambda = -93.23928$ (W)

Jensen Field, Rosemount, Minnesota

Synthetic Image (Processed GIS Data Displayed in Flightgear)

Geo-Registering: Assigning position coordinates to pixels in the images captured by the onboard camera.

$$\Lambda = 44.981562 \text{ (N)}$$
$$\lambda = -93.23928 \text{ (W)}$$

Jensen Field, Rosemount, Minnesota

Video Image Captured from UM Rascal #2
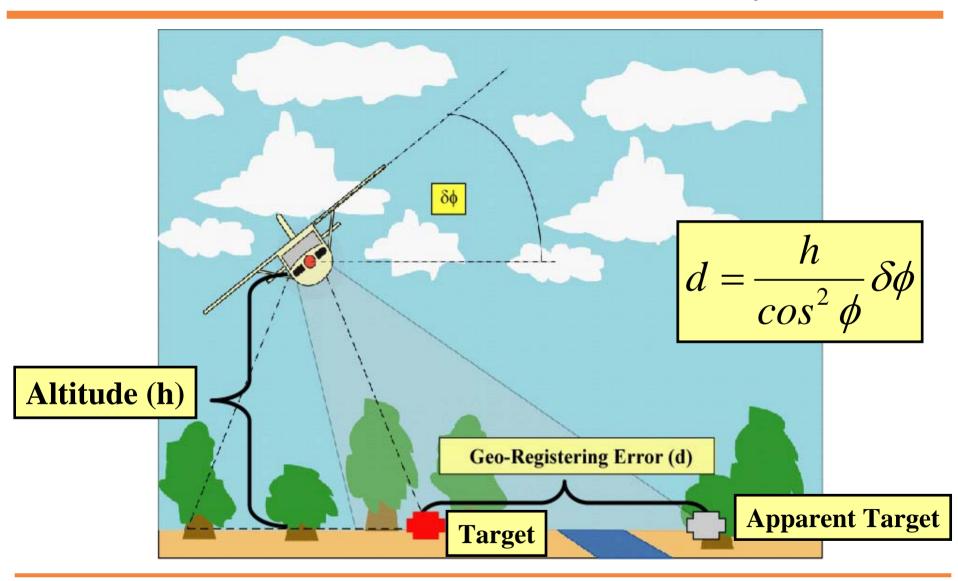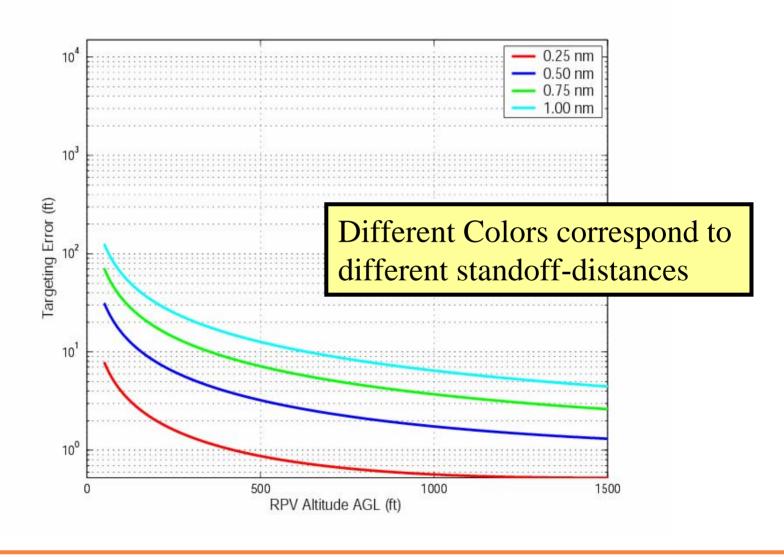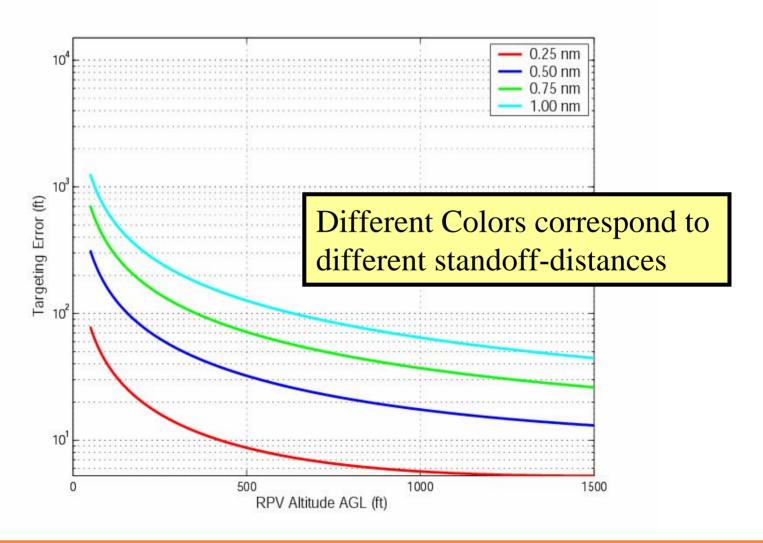
One Dimensional Error Analysis
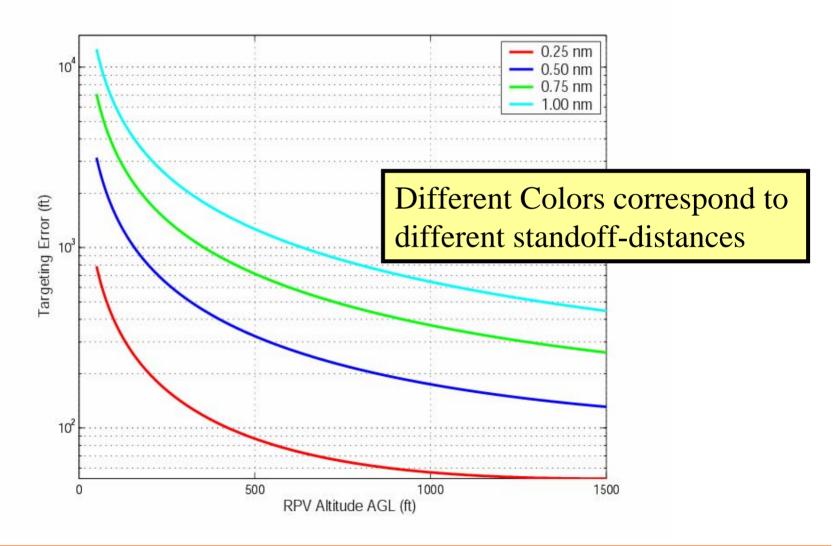
Effect of a 0.01^0 Pointing/Attitude Error

Effect of a 0.1^0 Attitude/Pointing Error

Different Colors correspond to different standoff-distances

Effect of a 1^0 Attitude/Pointing Error

Different Colors correspond to different standoff-distances
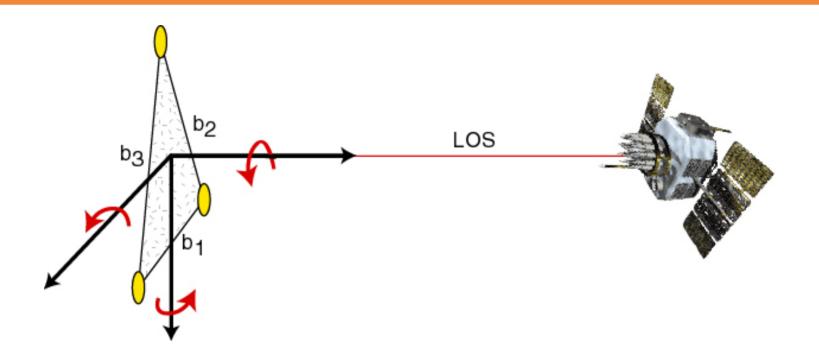
Navigation and Attitude Sensors
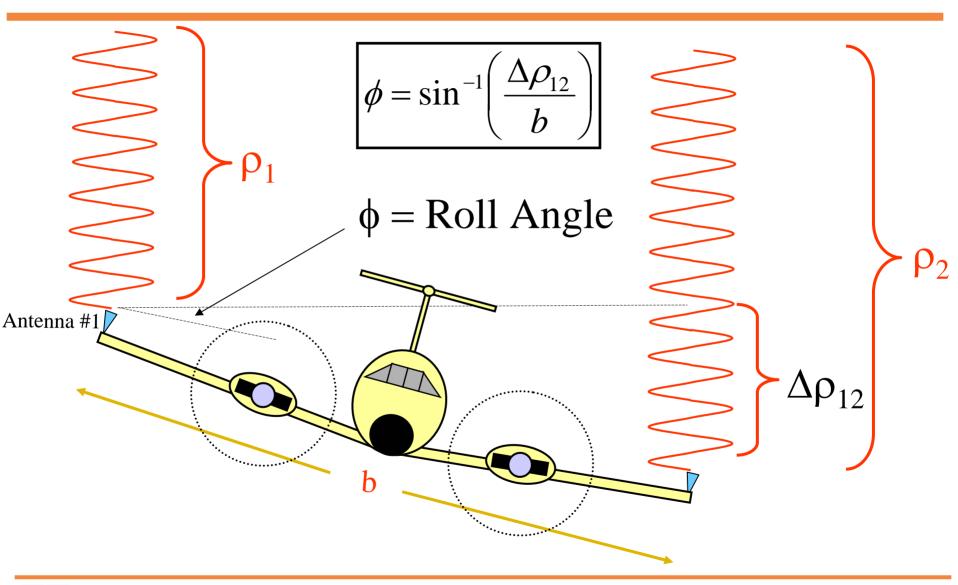
- Position and Velocity Estimation
  - GPS augmented by the FAA's Wide Area Augmentation System (WAAS).
  - Must ensure that the navigation solution has the integrity required for the application on hand.

- Attitude Estimation
  - 1st Generation: MIDG II GPS/INS from Microbotics Inc.
    - Triad of magnetometers, triad of accelerometers, triad of rate gyros aided by GPS.
    - Cannot achieve required accuracy in all potential maneuvers
  - 2nd Generation: Multi-antenna GPS attitude system
    - Triad of Novatel Superstar II receivers
    - Modified to run off a common oscillator

GPS Based Attitude Determination

- A planar array of 3 or more GPS antennas can be arranged so that they define a plane.
- Orientation of the plane can be determined by knowing the difference in range from the antennas to GPS satellites

GPS Attitude Determination

$$\phi = \sin^{-1}\left(\frac{\Delta\rho_{12}}{b}\right)$$

ρ_1

ρ_2

$\phi = $ Roll Angle

Antenna #1

$\Delta\rho_{12}$

b
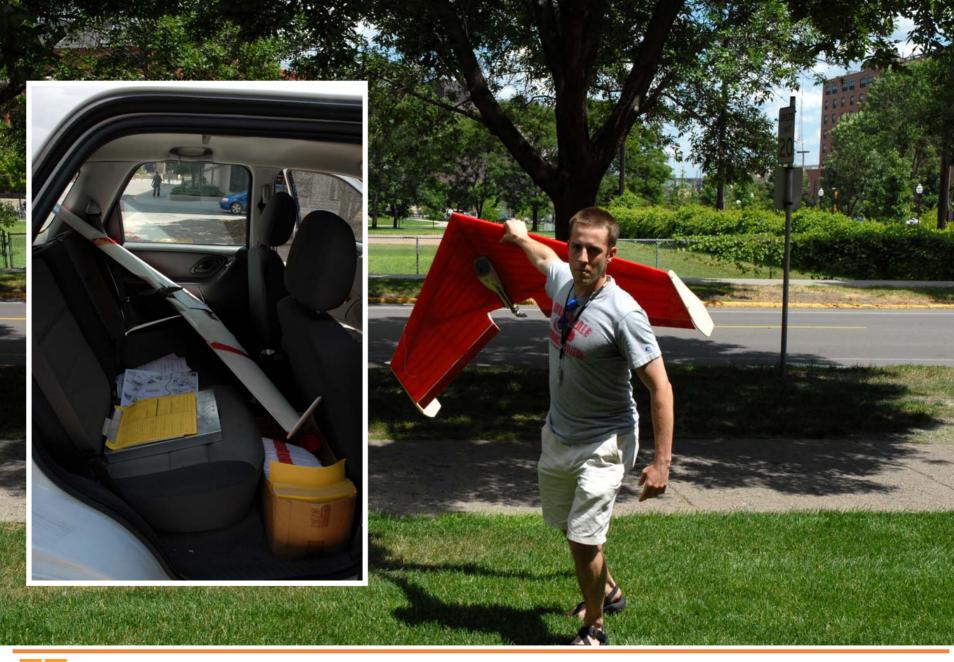
GPS Attitude Determination System

- Carrier Phase Differential GPS Attitude determination system.

- Three antennas in a short baseline configuration

- Three Novatel SuperStar GPS receivers:
  - WAAS capable
  - Differentially corrected position and accurate velocity output
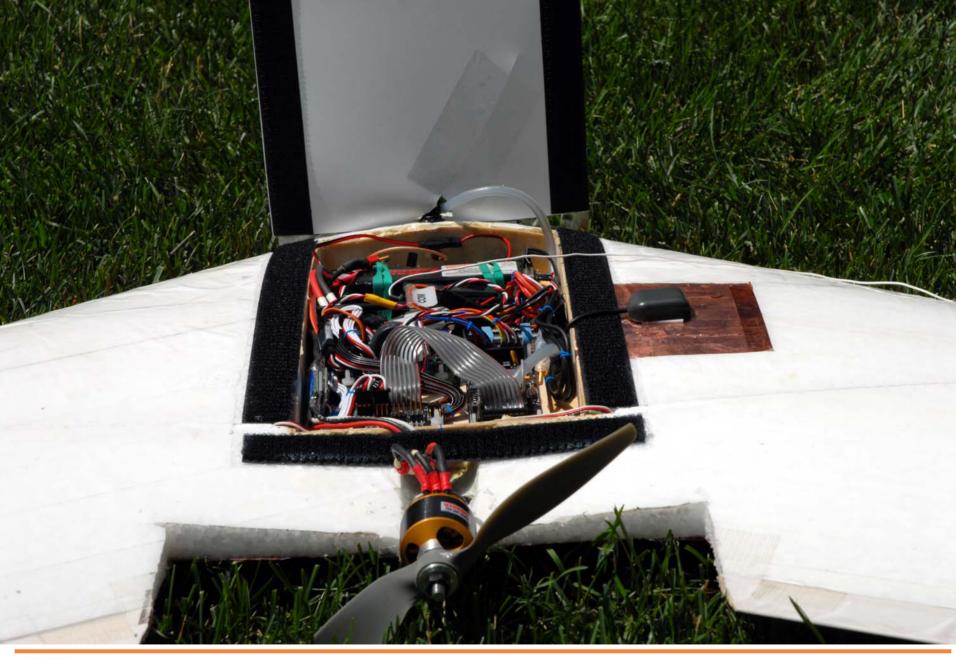
- Receivers have been modified to run off the same oscillator
  - Makes attitude algorithm more robust
  - Makes attitude algorithm more accurate

Summary and Conclusions

- The use of RPV in support of tactical ITS or law enforcement operations is practical and possible in the current regulatory environment.

- Regulatory issues associated with operation in the National Airspace System make strategic UAV/RPV operations much more challenging.

- Many attitude determination solutions which appear or are advertised to be off-the-shelf may not be quite suitable for UAV/RPV applications

Acknowledgements

- We acknowledge the support of the following organizations:
  - ITS Institute at the University of Minnesota
  - Minnesota Department of Transportation
  - SRF Consulting
  - Minnesota State Patrol
  - Honeywell International Inc.
  - Lockheed Martin Corporation
- Graduate students/research staff who contributed to this work are:
  - Curtis Olson
  - Greg Nelson
  - Troy Wigton
  - Romeo Ahohe

Communication Interoperability:
A Daily Problem

Mike Greene
Director, Homeland Security Solutions

michael.f.greene@baesystems.com

www.FirstInterComm.com

Description of the problem

– Public safety requires that emergency responders be able to communicate in real time with all event participants

– Today, U.S. agencies cannot easily share information when responding to
  – routine operations
  – large-scale events, such as acts of terrorism or natural disasters

– Incompatible legacy communications equipment used by more than 60,000 federal, state, local, and tribal agencies

– Cost of new equipment prevents total replacement

– Interoperability essential to achieving full communications

Solutions in use today

- Quick solutions
  - side-by-side
  - swapping radios
  - sharing frequencies
- Some equipment necessary
  - radio cache
  - bridges and gateways
- Expensive equipment solutions
  - specially equipped vehicles
  - regional replacement of radios
  - Project 25 (P25)
- Voice and data solutions
  - Wi-Fi
  - 4.9 GHz

Quick solutions

Side-by-side

Responders standing next to each other relaying messages between multiple agencies

✓ Works for small incidents with few participants

- Ties up responders that were sent to help
- As more agencies arrive, this quickly gets unwieldy

Quick solutions (continued)

Swapping radios

Agencies give each other radios compatible with their own

✓ Works for small incidents with few participants

- Multiple radios at Incident Command Post becomes confusing
- May require responders assigned to radios again
- Only addresses agencies equipped in advance

Sharing frequencies

Agencies agree to use common frequency(ies) at incidents

✓ Works for small incidents with few participants

- Many responders needing to communicate causes congestion on one frequency
- Only addresses agencies that have agreed and have been equipped in advance

Some equipment necessary

Radio cache

Region keeps a cache of radios saved
for significant events

✓ Some number of responders at the scene can talk to each other

- Does not help day-to-day
- Handing out unfamiliar radios to responders at incident scene
- Cache has to be inventoried and maintained

Bridges and gateways

Devices connect two or more frequencies

✓ Some number of agencies at the scene can talk to each other

- Special training/knowledge required
- Requires preplanning and coordination
- Correct equipment must be on hand/on scene

Expensive equipment solutions

Specially equipped vehicles

Multiple radios with gateways mounted in special purpose vehicles

✓When it works, it works well

- Expensive equipment, vehicle, personnel
- May be hours away; if available at all
- Only deployed for significant incidents
- Take time to set up; difficult to maintain

Regional replacement of radios

Purchase new radios for responders in a region

✓All responders with compatible radios can talk to each other

- Only works within the region
- Expensive infrastructure and equipment

Expensive equipment solutions (continued)

Project 25 (P25)

Deploying new P25 radios to all responders in a region

✓ All responders with new, P25 radios can talk to each other

- Only works within the region
- Expensive infrastructure and equipment
- Currently P25 radios are not all compatible

Voice and data solutions

Wi-Fi

New devices designed to operate in the 2.4 GHz spectrum

✓All responders with new, compatible devices can talk to each other

- Only works within the region
- Expensive infrastructure

4.9 GHz

New devices designed to operate in the 4.9GHz spectrum

✓All responders with new, compatible devices able to talk
✓4.9 GHz range is reserved for public safety

- Only works within the region
- Expensive infrastructure and equipment

Does this matter to First Responders?

First responders need to communicate with each other

Lack of communications is unsafe

DHS is trying to help as well

SAFECOM Program

– Established the Statement of Requirements (SoR) for public safety communications interoperability

– Interoperability Continuum

National Baseline Survey
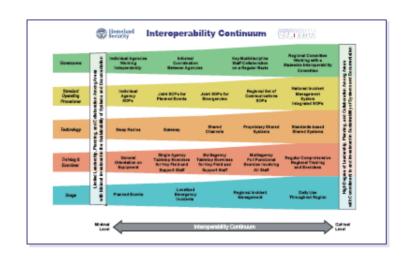
– Defines current situation

Grant Programs

– New focused on interoperability

Looking toward the future

– Unified Incident Command and Decision Support (UICDS)

– First Net

– Emphasis on video and voice

Advanced solution compliant with SAFECOM SoR - First InterComm™ Solution

– First Responders use existing, familiar radios

– Useful every day

– Scales to incident size

– No infrastructure required

– Allows responders to follow standard operating procedures

– Connects civil and military radios

– Digital solution compatible with latest (P-25) radios

We Protect Those Who Protect Us®

BAE SYSTEMS

REAGENTLESS HAND-HELD REAL-TIME EVANESCENT OPTICAL CHEM-BIO DETECTION USING BIOMIMETIC RECEPTOR AND LIGAND NANOSURFACES
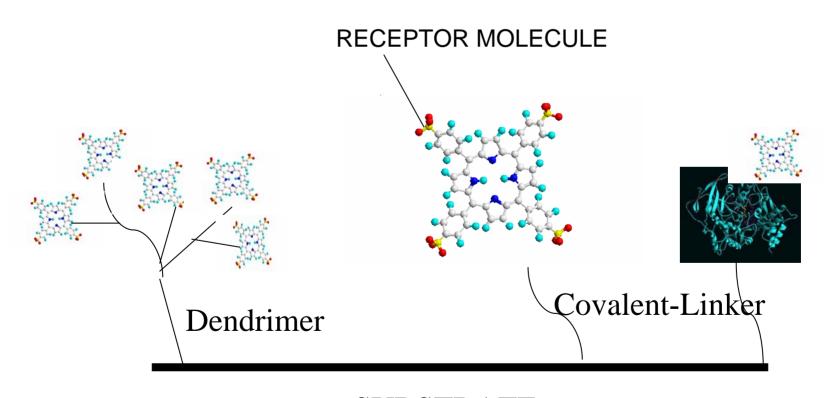
H. James Harmon and Amanda L. Oliver
Oklahoma State University
Stillwater, OK 74078

2007 Heartland Security Conference
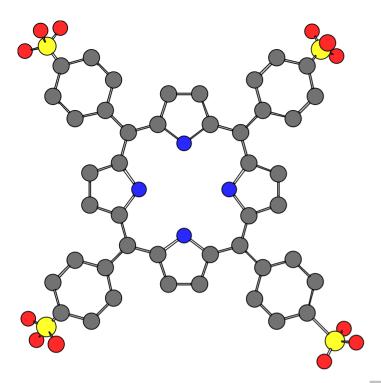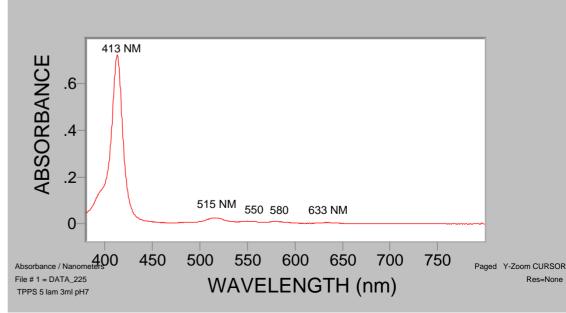**July 9-11, 2007**
Minneapolis, MN

CBEAR
Chemical, Biological,
and Energetic Agent
Research

"Some days you eat the bear; some days the bear eats you!"

Chemical Structure of Surface Monolayer

RECEPTOR MOLECULE

Dendrimer

Covalent-Linker
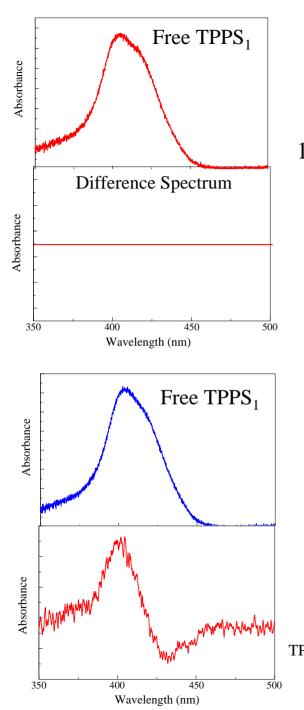
SUBSTRATE

Porphyrin? What's that?

Free TPPS$_1$ (top-left absorbance plot, Absorbance vs Wavelength (nm), 350–500)

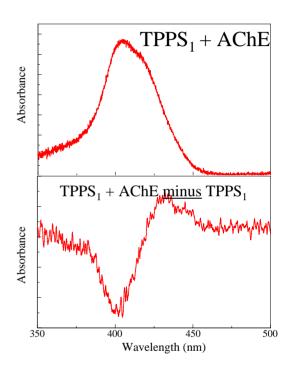**Difference Spectrum** (middle-left flat absorbance plot, Absorbance vs Wavelength (nm), 350–500)

1) Porphyrin in solution

2) Formation of TPPS$_1$-AChE complex
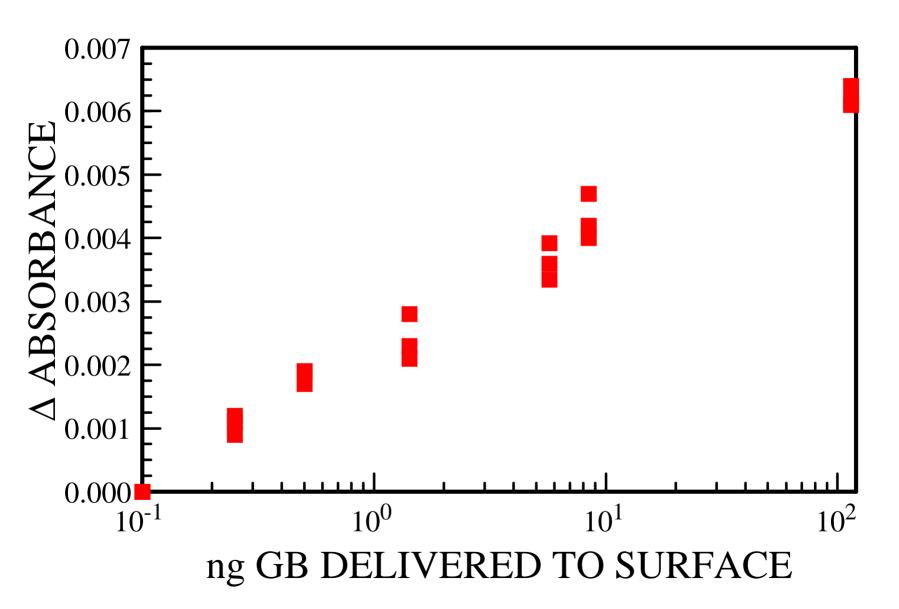
3) Dissociation of TPPS$_1$AChE Complex
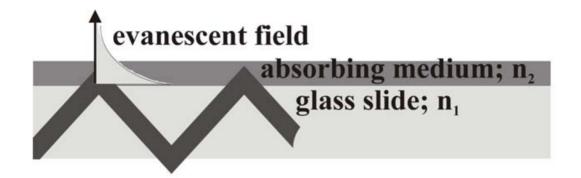
TPPS$_1$-AChE + Inhibitor <u>minus</u> TPPS$_1$-AChE

Free TPPS$_1$ (bottom-left blue absorbance plot, Absorbance vs Wavelength (nm), 350–500)

TPPS$_1$ + AChE (top-right absorbance plot, Absorbance vs Wavelength (nm), 350–500)

TPPS$_1$ + AChE <u>minus</u> TPPS$_1$ (bottom-right difference plot, Absorbance vs Wavelength (nm), 350–500)
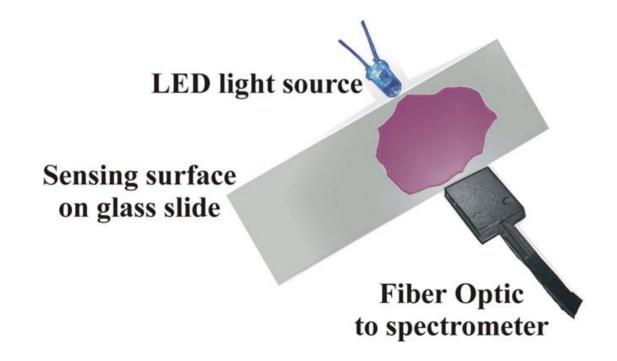
RESPONSE OF AChE SURFACE TO AEROSOL GB

EVANESCENT ABSORBANCE MEASUREMENT

evanescent field

absorbing medium; n_2

glass slide; n_1

LED light source

Sensing surface
on glass slide

Fiber Optic
to spectrometer

WHAT CAN WE DETECT?

- Cyanide (1 ppb gas or 1 μg/l; 10 ppm upper limit)
- Sarin (0.1 ng/liter liquid, > 10 ng/liter upper limit; 25 ng gas, >10 μg upper limit)
- Dipicolinic acid found in anthrax exospore (1.5 ppb solution, 250 ppb upper limit)
- Pentachlorophenol (1 ppb in solution; 1 ng/liter)
- Paraoxon (0.007 ppb in solution, 10 ppb upper limit)
- Diazinon (0.01 ppb in solution, >10 ppb upper limit)
- HD vapor (0.1 ppb; >10 ppb upper)
- Benzene, naphthalene, hydrazine, formaldehyde and other TICs.
- Ozone
- CO_2 (0.1% or 1000 ppm LOD gas)

WE DON'T USE

- Antibodies
- PCR, DNA, or RNA
- Primers, aptamers
- Buffers, substrate solutions
- Secondary enzymatic reactions
- Preconcentrator (It is one itself)

HOW FAST CAN WE DETECT?

In many cases, less than

1 second.

HOW SENSITIVE IS IT?

Most published sensitive measurement so far is

7 ppt (0.007 ppb)

We can do 30-fold better.

LIFETIME?

- Porphyrin surfaces are useable for

OVER 4 years

without special storage (room, unsealed)

- Enzymatic surfaces are useable for

>480 days sealed

(and counting)

Current Functional Modular Prototype

NEW GENERATION BIOMIMETIC BIOSENSOR

- Instead of binding a specific enzyme, we bind a specific protein or molecule that will bind the cell, virus, toxin, or whatever.

- After that, everything is the same.

- Same hardware

- Same slides, different coating material!

- Different proteins and/or porphyrins (we buy)

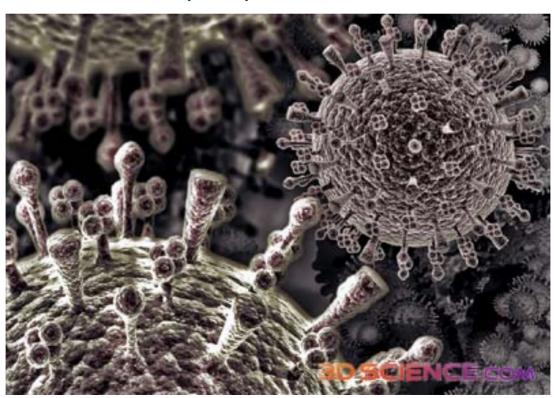# NATURE HAS ALREADY SOLVED THE PROBLEM!

WHAT CAN BE DETECTED WITH THIS BIOSENSOR?

- PSA (prostate specific antigen)
- Several lymphomas secrete a carbohydrate called "T-antigen" into the blood stream which can be used as an indicator of some cancers.
- Ricin can be bound by ConA and other lectins.
- Cholera toxin; other toxins as well.
- Influenza virus; other viruses.
- Bacteria of all sorts.
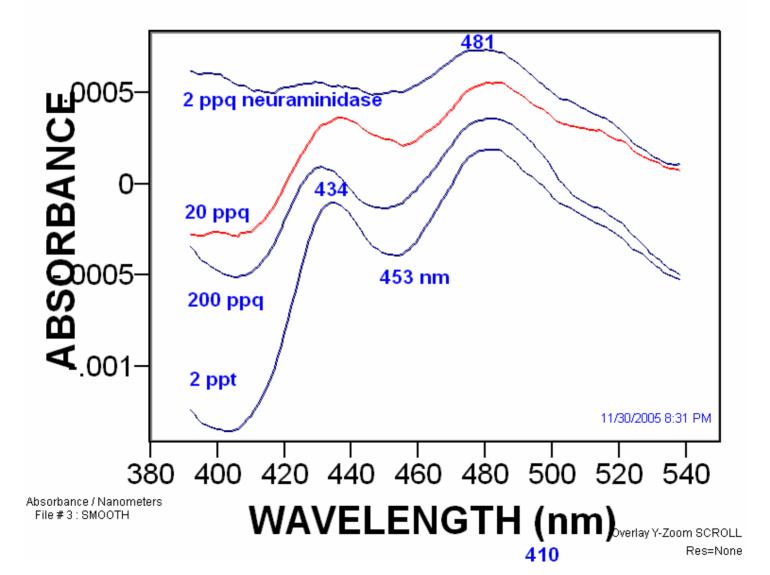
Influenza Virus

- Contains two glycoproteins
  - Hemagglutinin (HA) binds sialic acid
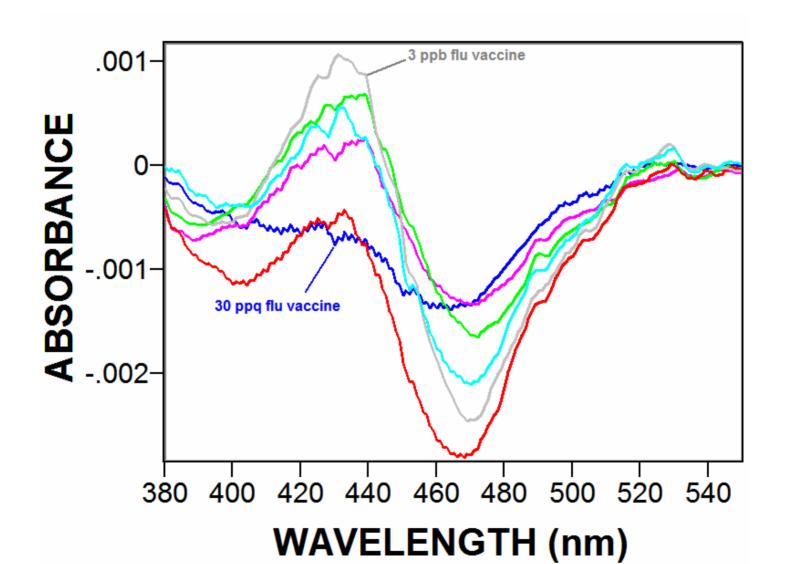 - Neuraminidase (NA) cleaves sialic acid

For the detection of influenza a sialic acid-porphyrin derivative is covalently immobilized.

Cleavage of the sialic acid will alter the electron density distribution and thus the spectrum of the porphyrin.

Difference spectra of porphyrin slides exposed to NA
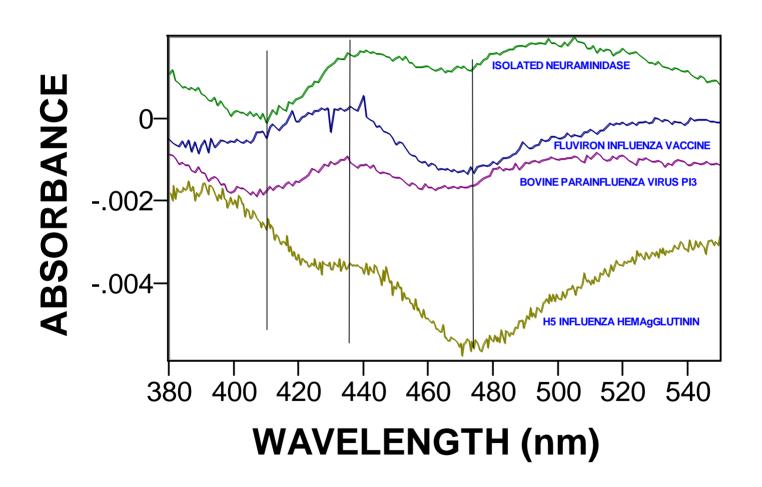
Difference spectrum of porphyrin slides challenged with human influenza virus

How much is this, REALLY?

- 30 ppq (0.03 pptrillion) is about 5 X 10^{-17} M neuraminidase

- This is about 30 X 10^6 NA/liter

- In our sample, this is about 6000 NA molecules.

- The average virus surface has about 400 NA molecules. We can bind HA, too!

- If we could bind <u>ALL</u> the NA on a virus, this means we had 15 virus in our sample.

THE SPECTRAL RESPONSE IS DIFFERENT AND SPECIFIC FOR DIFFERENT VIRUS AND ANTIGENS!

WE CAN DETECT:

Our sensors can detect:

- T- antigen 100 ppt

- Cholera Toxin at 100 ppq

- Human influenza at approx. 15-50 virus/ml

  AND we can <u>distinguish</u> between Human and Avian and bovine parainfluenza!

(Still, don't smear chickens on your face!)

WHERE DO WE GO FROM HERE?

We have the protocols to detect:

- Shigella
- Neisseria
  - Meningitis
  - Gonorrhoea
- Listeria
- Staph
- Strep
- Rabies
- Polio
- Ebola
- Dengue
- SARS
- RSV
- Norwalk Virus

And more!

What Can Be Used as Receptors?

- Carbohydrates
- Lipids
- Nucleic acids
- Proteins (Your genetically engineered protein here!)
- Phage!

ADDITIONALLY

- The surfaces can be archival
- Live vs dead microbes and intact vs fragments can be determined (that is a whole different additional presentation)
- Intact vs fragments of:
  - Microbes
  - Spores
  - Virus

FALSE POSITIVES?

Biological False Positives can be caused by:

- –Similarly reactive biological entities (similar to cross-reactivity of antibodies); choose your molecules wisely and use multiple receptors with LOGIC!

- –Fragments of the biological entity

- –Dead Cells

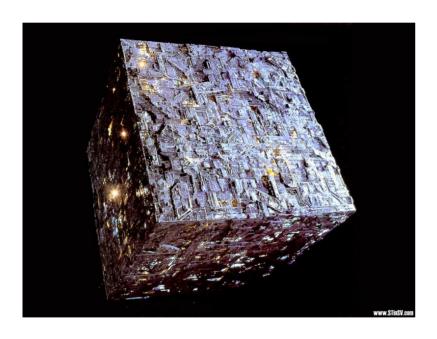False positive rate is that expected using antibody-based assays.

BARRIERS TO READINESS?

- 4 PROTOTYPES already exist and have been used since 2001.
- We do not use **Simulants** since the "normal" simulants such as MPA, DMMP, etc have *NO* effect on our enzyme-based sensors simply because the "simulants" are non-toxic to the enzyme and do not affect the cholinesterases. MPA, DMMP, etc are simulants on the basis of physical properties, not physiological/toxicological properties.
- This means that testing of the sensors must involve "real" toxic or somewhat toxic agents.
- And that costs $$$$$ since we must measure effects of:
  - Concentration dependence
  - Temperature
  - pH
  - Humidity

Testing must be done for each agent; the cost and time of testing presents a barrier for any new technology.

Some have told me directly "Nobody can do this". My response" "Almost nobody".

Thank You for trying to pay attention!
These technologies are patented or pending and available for licensing.

Resistance is futile. You <u>will</u> be assimilated.

CBEAR
Chemical, Biological, and Energetic Agent Research

"Some days you eat the bear; some days the bear eats you!"

Using Modeling and Simulation for Homeland Security Applications

Paul Huang

BAE Systems
4800 East River Road
Minneapolis, Minnesota
(763) 572-7905
paul.huang@baesystems.com

Content

- Modeling and Simulation at BAE Systems Armament Systems

- State of Real-Time Data Processing and Display Technologies

- Computer-Based Decision Aid Tools and Visualization Tools

- Potential Applications for Homeland Security

- Scenario Planning/Emergency Evacuation/Site Protection/Bio-Chem Neutralization

- Pathforward

- Q & A

Modeling and Simulation
at BAE Systems Armament Systems

- Physics Based Modeling

- Scenario Modeling and Simulation

- Interactive Modeling and Simulation

- Virtual Environment Generation

- Trainers and Trainings

Physics Based Modeling

BAE SYSTEMS
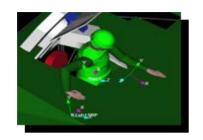
Human Factors Engineering
- **SafeWork**
- **Jack**
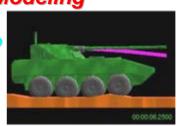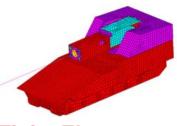
Dynamic Modeling
- **DADS**
- **Virtual.Lab**
- **RecurDyn**
- **Recoil_V2**

Finite Element Modeling
- **NASTRAN**
- **ABAQUS**

Thermal Modeling
- **CFX**
- **WIND**
- **ANSYS**
- **VTT**

Pro-E Master Model

"Real Time" Simulation & Visualization
- **Division**
- **Coryphaeus**
- **VEGA / VEGAPrime**

Pro-Manufacturing
- **NC Tool Module**
- **Sheet Metal Module**
- **Mold Module**
- **CMM** (Coordinate Measuring Module)
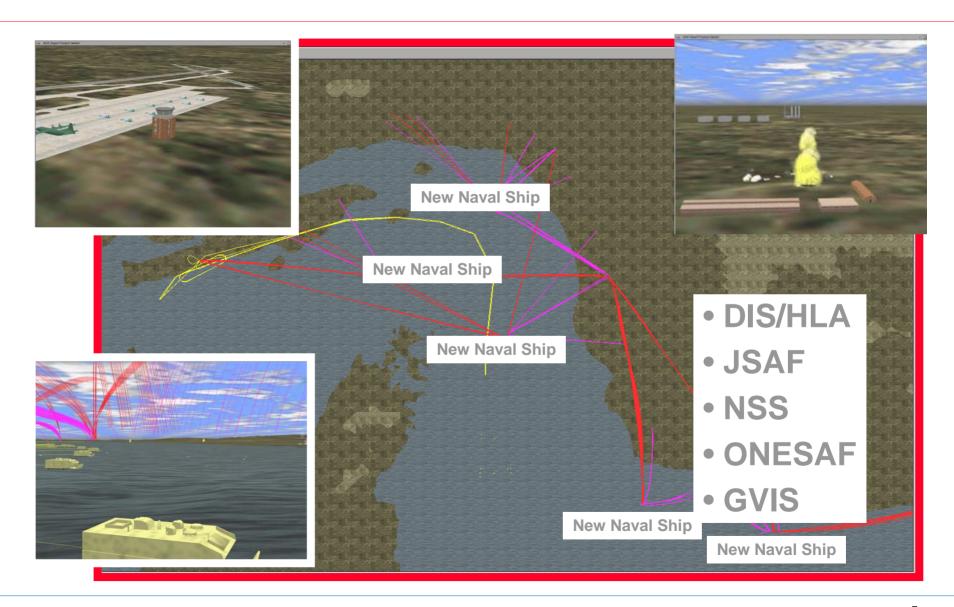
BRL - CAD

Survivability Analyses
- **Signature Analyses**
- **Shot Line Analyses**
- **Compartment Level Vulnerabitliy**

Scenario Modeling and Simulation

- **DIS/HLA**
- **JSAF**
- **NSS**
- **ONESAF**
- **GVIS**

New Naval Ship

New Naval Ship

New Naval Ship

New Naval Ship

New Naval Ship

Interactive Modeling and Simulation

Real Person perform control functions in Virtual Environment

Virtual Environment Generation
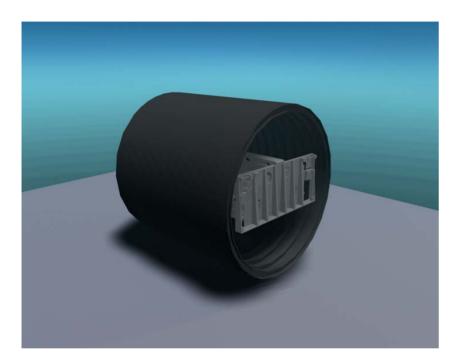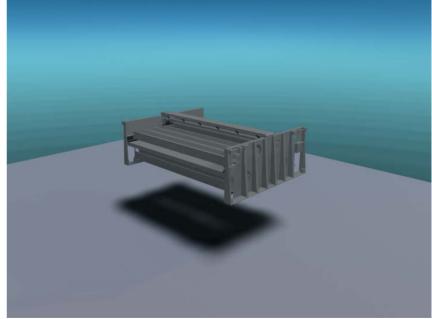
Trainers and Trainings

State of Real-Time Data Processing and Display Technologies

Computer-Based Decision Aid Tools and Visualization Tools
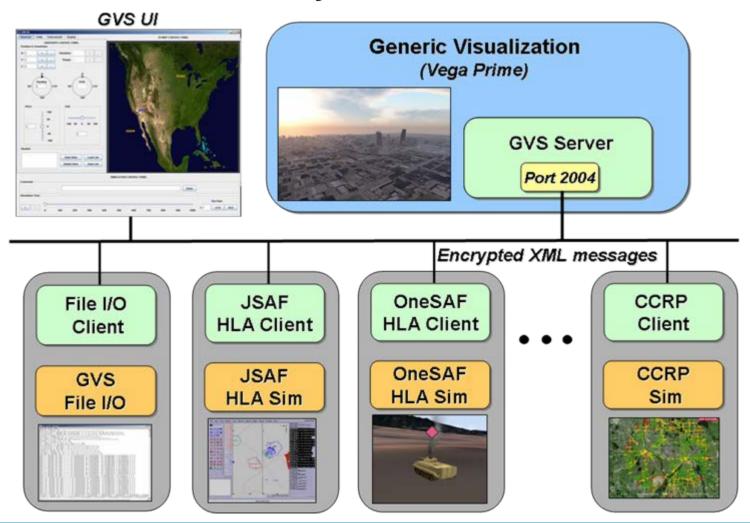
Visualization Tools and Environment

Generic Visualization System Architecture

Potential Applications for Homeland Security

- Homeland Security Task Planning and "War Game"
- Training
- Mission Execution Exercises and Planning (including hybrid systems)
- After Action Review
- Hand Held Decision Aid
- Portable Control and Command Center
- Sensory Systems tracking and display
- Emergency Response Team tracking and control

Homeland Security Example Activities

- Scenario Planning

- Emergency Evacuation

- Site Protection
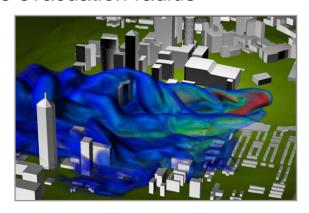
- Bio-Chem Neutralization

- Human & Resource Tracking
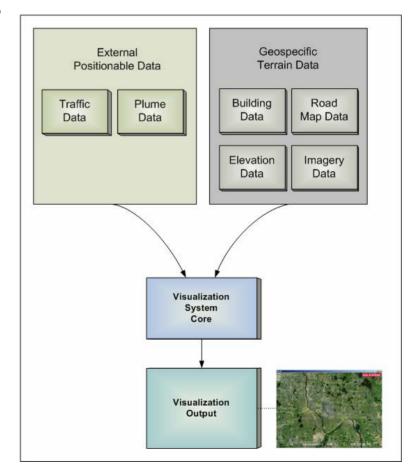
Evacuation Route Planning Scenario
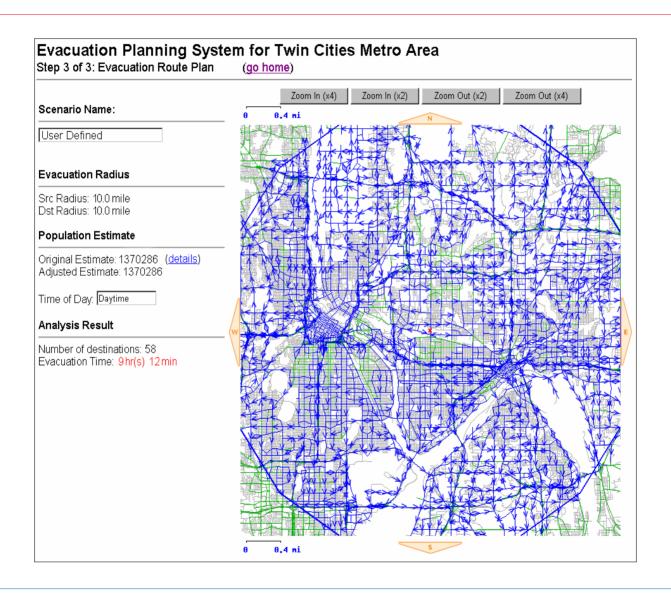
- Playback of data from multiple simulations
  - Computational fluid dynamics modeling of contaminant cloud
  - Routing planner for optimizing evacuation routing
- Biochemical attack on an urban environment
  - Biochemical plume propagation through city
  - Population evacuates outside of a 1-mile evacuation radius

Emergency Evacuation
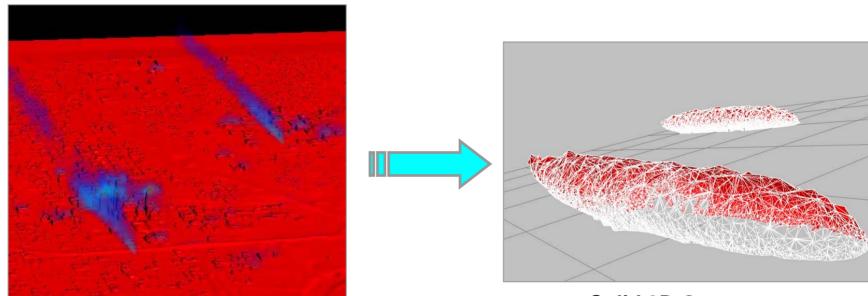
Site Security Planning

Bio-Chem Neutralization

Plume Computational Fluid Dynamics Model

Solid 3D Geometry

Human and Resource Tracking

- Enable technologies are maturing fast:
    - GPS, wireless, and new generation of tags
    - Digital Angel (producer of GPS, RFID integrated microchips)
    - Ekahau Wi-Fi Real time Location system
    - GPSOne (widely used commercially)
    - BREW (Binary Runtime Environment for Wireless)
- We can track human beings and resources "almost" 24/7

Pathforward

- Investigate and apply more dual usage technologies and practices (dismounted infantry/ERT member tracking, for example) in HSD
- Combine computer-generated "virtual" environment and objects for personnel training, exercise, and testing

Questions & Answers

LocalEyes

Mobile Reporting

MITRE

Mobile Reporting
by First Responders

Ubiquitous Computing

2006   **2.6 Billion Subscribers**

1 Trillion Text Messages
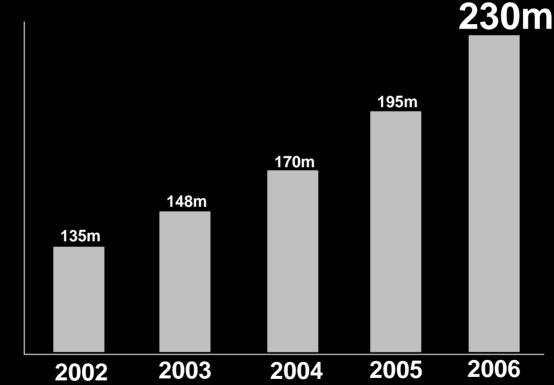
2010   **4 Billion Subscribers**
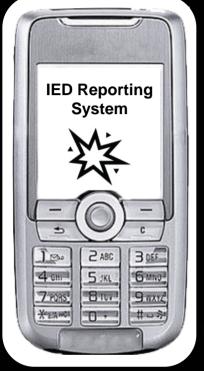
2.3 Trillion Text Messages

Gartner

Ubiquitous Computing

Cell phones in U.S.

230m — 2006
195m — 2005
170m — 2004
148m — 2003
135m — 2002

CTIA

4

Integrated Technology..

Cell Phone, GPS, Camera

IED Reporting System

… Public Infrastructure

Unlimited Applications

First Responders

Real Time Alerts

Area Alert

Force Tracking

Rescue

Terrorist Activities

LocalEyes Vision

- Mobile reporting with global scale

- Machine-to-Machine reporting

- Rapid response, flexible platform

- Low cost, leverage existing infrastructure

- Ability to transition system to locals

Enable local population to be our 'sensors'… our *local eyes*

LocalEyes Scenario

① Identify Activities

- **Policing**

- **Monitoring Ports and Infrastructure**

- **National Security**

- **Terrorist Activities**

- **Disaster Relief**

- **Emergency Management**

- **Civil Unrest**

A Operations Center determines reporting need

B Define event types

Suspicious Package

Suspect

Bombing

Protestors

Fire

Suspicious Vehicle

Amber Alert

Medical Support Request

Road Closure

Traffic

Accident

Auto Theft
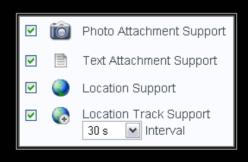
C Configure features
- Photos, Video
- Text
- GPS Force Tracking

Photo Attachment Support

Text Attachment Support

Location Support

Location Track Support
30 s Interval

Operations Center PUSH applications to phones

Users PULL applications directly from phones

4 Users Report
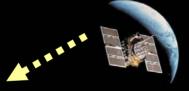
A Start LocalEyes application

LOCAL EYES
Event Reporting

B Choose event type from list …

Suspicious Package → Suspicious Truck → Traffic

GPS support provides location

C Attach photo, video, text (optional)

Submit to Operations Center

D
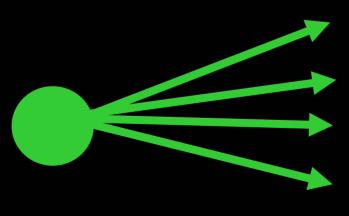
Operations Center receives real-time reports

Visualize & Analyze

Integrate with other Command and Control Systems

Mission Planning Systems

Battle Command Information Systems

Google Maps

Google Earth

Field conditions change rapidly
- New event types
- Different bombing suspects
- Recovery efforts change

Operations center can respond with application changes in minutes….

Mobile user is automatically updated during next event report.

Boston - 4th of July

Boston 4th of July

Massachusetts State Police

- **Piloted LocalEyes reporting capability**
- **350,000 in attendance**

Integrated Reporting

- **Unified Command Center**
- **Massachusetts State Fusion Center**

Boston 4th of July

Event Reporting

- **Suspicious Person, Vehicle**
- **Unattended packages**
- **Missing Children**

Boston 4th of July

Future Collaboration & Operations
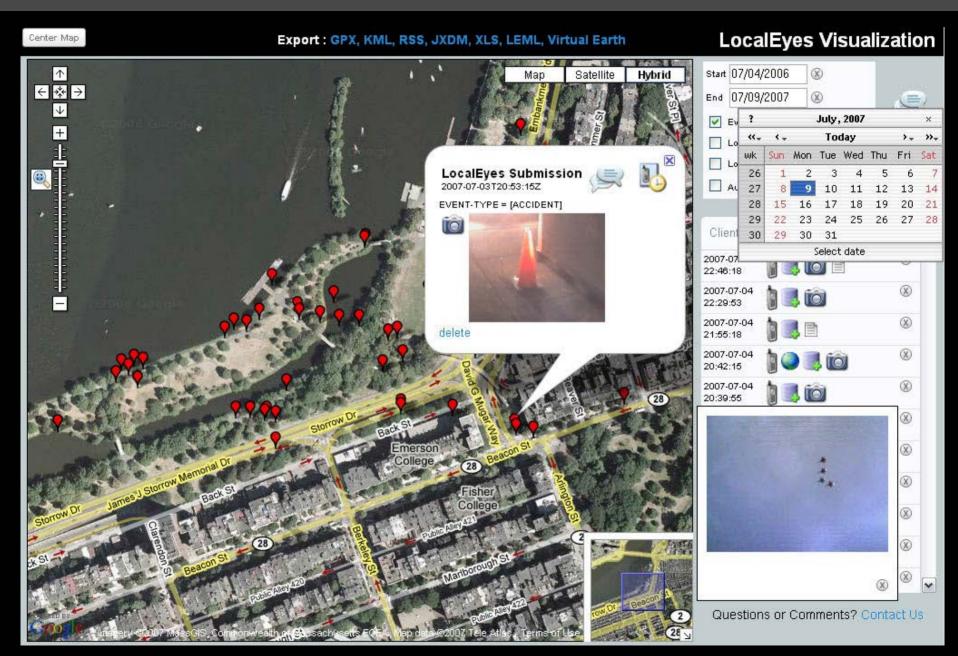
- **Massachusetts Emergency Management Agency**
- **Boston EMS**

Visualization

Visualization

Different way of thinking

Information from first responders, patrol units, and civilians

Different way of building

Rapid deployment, flexible infrastructure

Matches changing field conditions

Technology can integrate with Command and Control Systems to improve current practices

LocalEyes

Team

Scott Hume, Project Lead Engineer

Brandon Wolfe, Technical Lead

NATIONAL COMMUNICATIONS SYSTEM

NCS

National Communications System

"Priority Telecommunications Services for Emergency Managers & First Responders"

Heartland Security Conference

Minneapolis, Minnesota

11 July 2007

Homeland Security

National Communications System

AGENDA

- **Overview of National Communications System**

- **Description of The Network Congestion Model**

- **Impact of Congestion On Emergency Incidents**

- **Description of NCS Priority Telecommunications Services**

- **Organizations and Individuals Who Qualify**

- **Administrative Support and Summary**

National Communications System
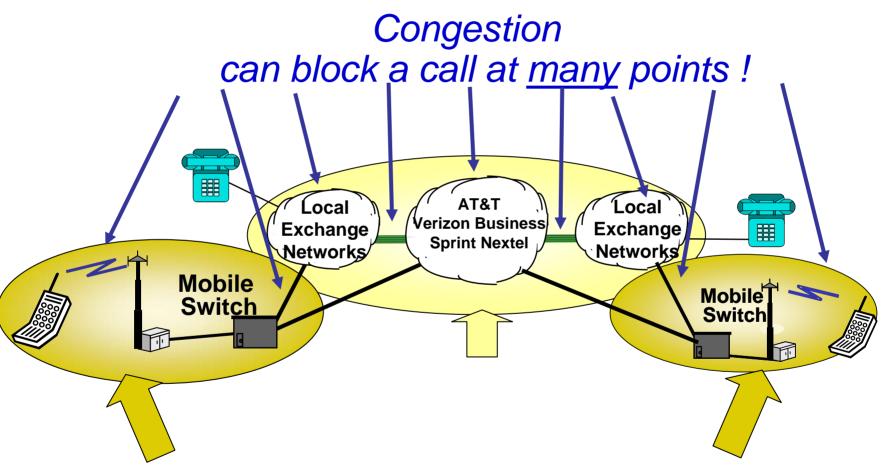
- The NCS works with the telecommunications industry to develop and deploy National Security and Emergency Preparedness telecommunications services

- Priority telecommunications services are available to qualifying federal, state, local, and tribal governments, plus selected industry organizations

- Priority telecommunications services are designed to augment existing emergency communications capabilities

National Communications System

Priority Telecommunications Services
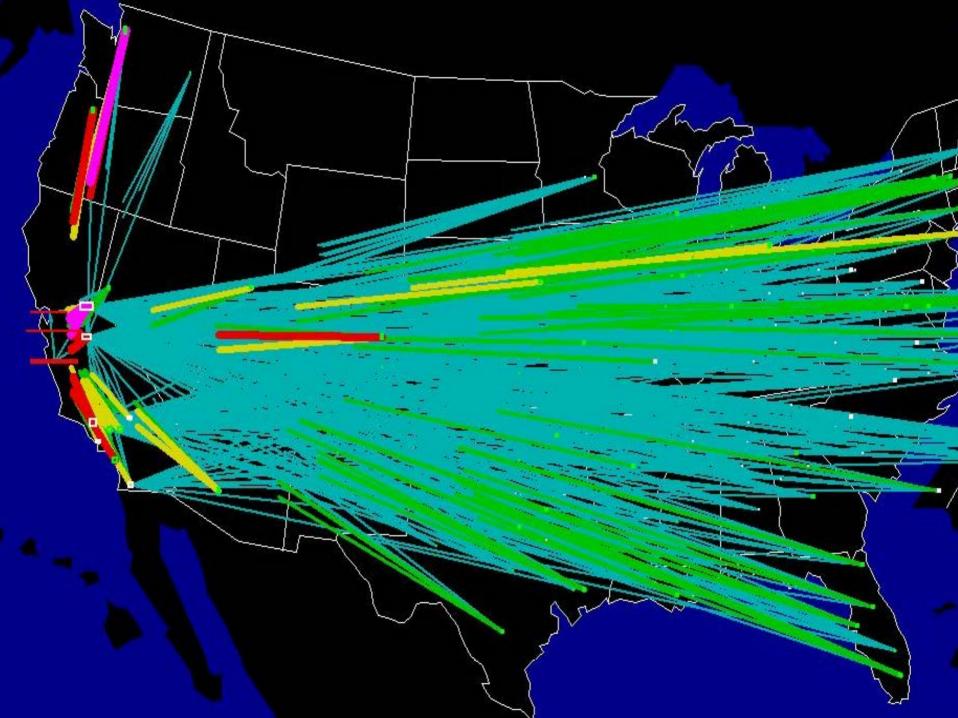
- **Government Emergency Telecommunications Service (GETS)**

- **Wireless Priority Service (WPS)**

The Fundamental Issue:
Emergencies Cause Network Congestion

Congestion can block a call at many points !

Local Exchange Networks

AT&T Verizon Business Sprint Nextel

Local Exchange Networks

Mobile Switch

Mobile Switch

Priority Telecommunications Services *address congestion at call origination _and_ call termination*

6

Hurricane Katrina

Network Damage

29 August 2005

- Damaged and Inoperative (Louisiana, Mississippi, and Alabama) Network Assets

  - More than 3 million customer phone lines
  - More than 1,000 cell sites
  - 38 9-1-1 centers
  - 33 central offices

Hurricane Rita Evacuation

Network Congestion!

- Heavy public calling out of area to families, friends, hotels

- Once the evacuation was underway, motorists made extraordinarily heavy use of cell phones

- TELCO networks invoked Automatic Network Management Controls – limiting inbound traffic

- Calls into 7 Area Codes began to get "Fast Busy" **3 days** before Hurricane Rita impacted the coast

EMERGENCY MANAGERS

What do you do .　.　.

.　.　. when the network is congested?

.　.　. when other communications resources are unavailable?

What are your options?

Solutions: The GETS Calling Card and Wireless Priority Service
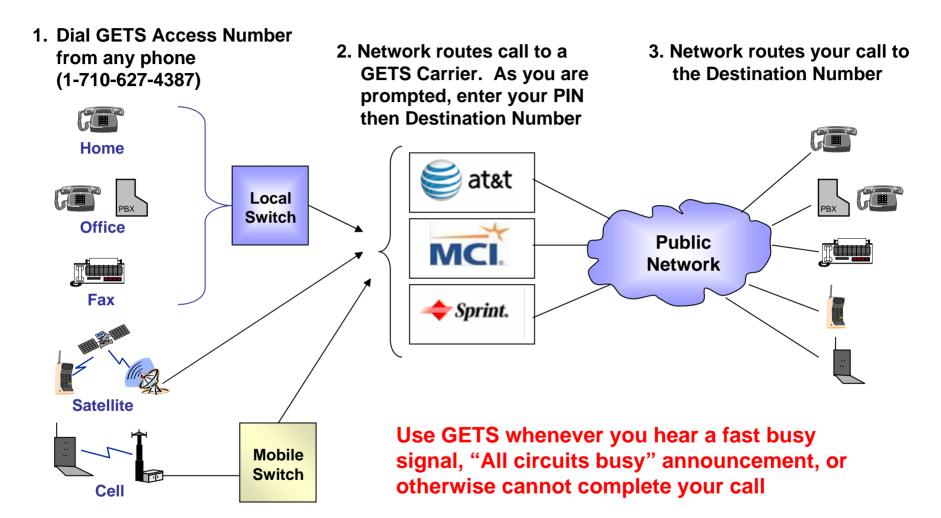
GETS is an emergency calling card service that can be used from <u>virtually any telephone</u> to provide priority for emergency calls
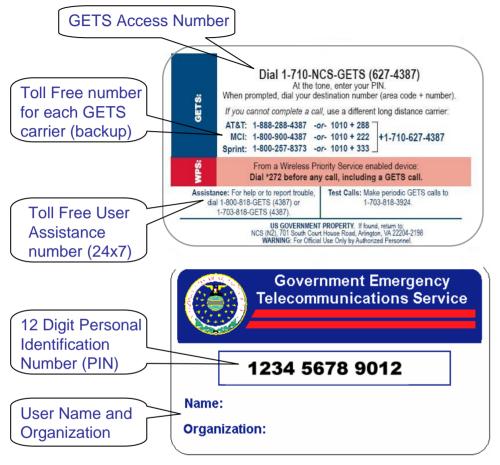
WPS is an add-on feature subscribed on a per cell phone basis – works with existing cell phones in WPS-equipped networks

GETS Overview

1. Dial GETS Access Number from any phone (1-710-627-4387)

Home

Office

Fax

Satellite

Cell

Local Switch

Mobile Switch

2. Network routes call to a GETS Carrier. As you are prompted, enter your PIN then Destination Number

at&t

MCI.

Sprint.

Public Network

3. Network routes your call to the Destination Number

Use GETS whenever you hear a fast busy signal, "All circuits busy" announcement, or otherwise cannot complete your call

13

Making a GETS Call

GETS Access Number

Dial 1-710-NCS-GETS (627-4387)
At the tone, enter your PIN.
When prompted, dial your destination number (area code + number).

If you cannot complete a call, use a different long distance carrier:

GETS:

AT&T: 1-888-288-4387 -or- 1010 + 288
MCI: 1-800-900-4387 -or- 1010 + 222 |+1-710-627-4387
Sprint: 1-800-257-8373 -or- 1010 + 333

Toll Free number for each GETS carrier (backup)

WPS:

From a Wireless Priority Service enabled device:
Dial *272 before any call, including a GETS call.

Assistance: For help or to report trouble, dial 1-800-818-GETS (4387) or 1-703-818-GETS (4387).

Test Calls: Make periodic GETS calls to 1-703-818-3924.

Toll Free User Assistance number (24x7)

US GOVERNMENT PROPERTY. If found, return to: NCS (N2), 701 South Court House Road, Arlington, VA 22204-2198
WARNING: For Official Use Only by Authorized Personnel.

Government Emergency Telecommunications Service

12 Digit Personal Identification Number (PIN)

1234 5678 9012

Name:

User Name and Organization

Organization:

1. **Dial GETS Access Number**

2. **Listen for tone, then enter your PIN (<u>do not</u> enter # after last digit)**

3. **Listen for voice prompt: "Please enter your destination number now."**

4. **Enter the destination number (omit the 1 before the area code)**

5. **You will hear an announcement "You are using GETS, AT&T/MCI/Sprint"**

6. **Network will route your call to the destination telephone number**

Periods of silence are normal – particularly if call is queued during heavy congestion. Calls may take 30 to 90 seconds to complete

Wireless Priority Service (WPS)

WPS is an add-on feature subscribed on a per-cell phone basis to provide priority for emergency calls made from cell phones. WPS works with existing cell phones in WPS-equipped networks

1 WPS provides priority access to the radio channel where local area congestion can often block calls

2 WPS automatically provides priority call processing across landline and cellular networks

Making a WPS Call

1. **Confirm radio signal** ..ıll

2. **Enter *272 + destination telephone number and push SEND key (example: *272 703 818 4387 - SEND)**

3. **Network will route call to the destination telephone number**

- **Screen messages** vary among carriers and mobile phone models.

- WPS calls show same screen messages as regular calls

- While WPS calls are in queue screen message usually displays "Calling + Destination Number"

- **Audible alerts** vary among carriers and mobile phone models

- During WPS call set-up you may hear alternating periods of ringing and silence

- Busy signal, announcement, or extended silence indicates call cannot complete

Periods of continuous ringing and/or silence may occur – particularly if call is queued at several points during heavy congestion. Calls may take 30 to 90 seconds to complete

Hurricane Katrina

29 August 2005

- Damaged and Inoperative (Louisiana, Mississippi, and Alabama)
  - More than 3 million customer phone lines
  - More than 1,000 cell sites
  - 38 9-1-1 centers
  - 33 central offices

- During the period 29 Aug – 9 Sep, there were 32,829 GETS calls into or out of the Gulf Coast region. **95% routed successfully.**
  - The New Orleans and Baton Rouge areas originated 33% of all calls and were the final destination for 26%

- There were 3204 attempted WPS calls -- **2970 (93%) were assigned a radio channel**

Hurricane Rita Evacuation

Network Congestion!

- Heavy public calling out of area to families, friends, hotels
- Once the evacuation was underway, motorists made extraordinarily heavy use of cell phones
- TELCO networks invoked Automatic Network Management Controls – limiting inbound traffic
- Calls into 7 area codes began to get "Fast Busy" **3 days** before Hurricane Rita impacted the coast

- **GETS and WPS ✳272 calls went through immediately from NCS North Texas operating center every time**

Who Should Have GETS/WPS?

Organizations

- Cities/Counties/States/Districts
- Offices of Emergency Services
- Police/Sheriff/Fire
- Water and Power, Telecom
- Irrigation Districts/Flood Control
- Public Health
- Hospitals/Medical Services
- Transit Agencies
- Ports/Airports
- Utilities/Transportation and other Industries
- Search and Rescue
- School and College Districts
- Critical Infrastructure Suppliers
- Agencies included in County Emergency Management Plans

Individuals

- Mayor, Council Members, Supervisors
- City Manager and staff
- Media Relations
- OES Management and staff
- Police/Fire Chiefs and staff
- Police/Fire Field Command
- Department Heads and staff
- Individuals with an Emergency Preparedness and Response role.

Locations/Functions

- EOC Work Stations
- Back-up EOC
- City and County Operations Centers
- PSAPs (911)
- Computer/IT Center
- Police/Fire Dispatch
- Remote Offices/Stations
- Power/Pump Stations
- Shelters
- Command Vehicles

Priority Services Administration

GETS

- No charge for GETS cards
- Accounts are established through NCS on-line ordering system
- Service available nationwide in public switched telecommunications networks

WPS

- Participating Carriers: AT&T, Sprint/Nextel, T-Mobile, Verizon Wireless, Southern LINC, Edge Wireless
- Ordered on a per-phone basis through NCS on-line ordering system
- Charges apply to WPS services
- Billed by the carrier on the cell phone invoice/bill

Emergency Preparedness Challenge

"Prediction is very difficult,
   especially if it's about the future."

- Niels Bohr

Nobel Laureate in Physics

Is Your Agency Fully Prepared?

- Are GETS and WPS part of your agency's emergency planning, preparation, and drills?
- Where can GETS and WPS augment existing emergency communications capabilities?
- Which individuals, locations, and functions are candidates for GETS and WPS?

Information Resources

For more information:

www.ncs.gov
www.gets.ncs.gov
www.wps.ncs.gov

Lee Johnson
Regional Outreach Coordinator
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Lee.Johnson@associates.dhs.gov

For assistance setting up on-line accounts and ordering:

Priority Telecommunications Service Center: **1-866-627-2255**
- 8am to 6pm Eastern Time
- Follow voice prompts for each service

Food Protection & the National Infrastructure Simulation & Analysis Center

Paul Kaplan
Sandia National Laboratories
SAND 2007-4293C

2007 Heartland Security Conference
Minneapolis, MN
July 10
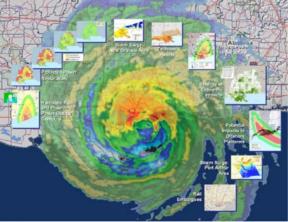
The National Infrastructure Simulation & Analysis Center

- ## Modeling, simulation, and analysis of
  - ### all critical infrastructures
    - interdependencies and national security consequences
  - ### formally established under the 2001 US Patriot Act
  - ### expanded under 2007 Homeland Security Appropriations Act
    - formal relationship with additional federal agencies

Food Safety Versus Food Defense

- ## Food Safety Inspection Service Definitions

  Food defense focuses on protecting the food supply from *intentional contamination*, with a variety of chemicals, biological agents or other harmful substances by people who want to do us harm. These agents could include materials that are *not naturally-occurring* or are not routinely tested for.

  Food safety addresses the *accidental contamination* of food products during processing or storage by biological, chemical or physical hazards. The main types of food safety hazards are microbes, chemicals and foreign objects. This unintentional contamination of food products can be *reasonably anticipated* based on the type of processing.

  Developing a Food Defense Plan for Meat and Poultry Slaughter and Processing Plants, January 2007, http://www.fsis.usda.gov/PDF/Food_Defense_Plan.pdf

Food Defense Versus
Food & Agricultural Infrastructure Defense

NISAC's Unique Role

Infrastructure defense focuses on understanding what *intentional and natural events,* regardless of which critical infrastructure is originally impacted, would threaten our ability to provide quality food to the citizens of America in sufficient quantity at an acceptable price.
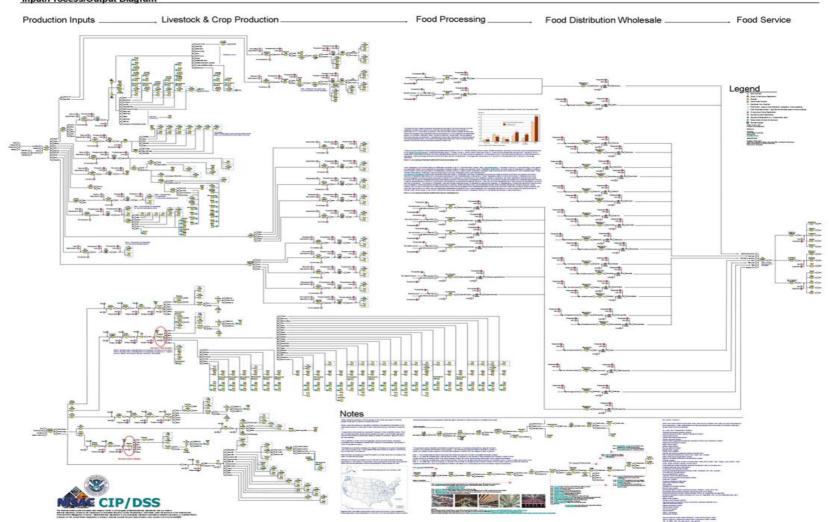
Food & Agricultural Infrastructure

Food & Agriculture Commodity Flow System Labor Inputs
Input/Process/Output Diagram

Production Inputs — Livestock & Crop Production — Food Processing — Food Distribution Wholesale — Food Service

Legend

Notes

NISAC CIP/DSS

5
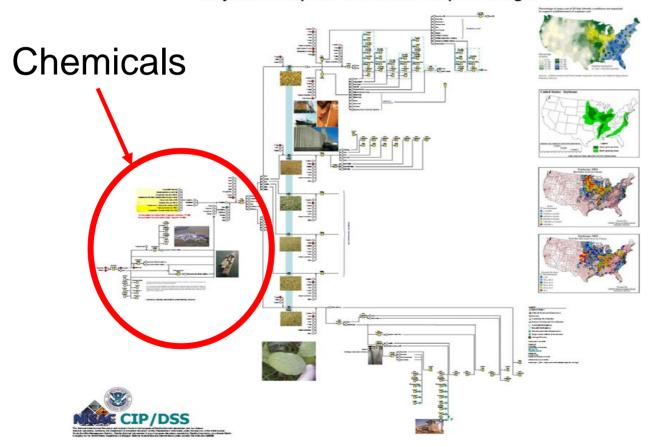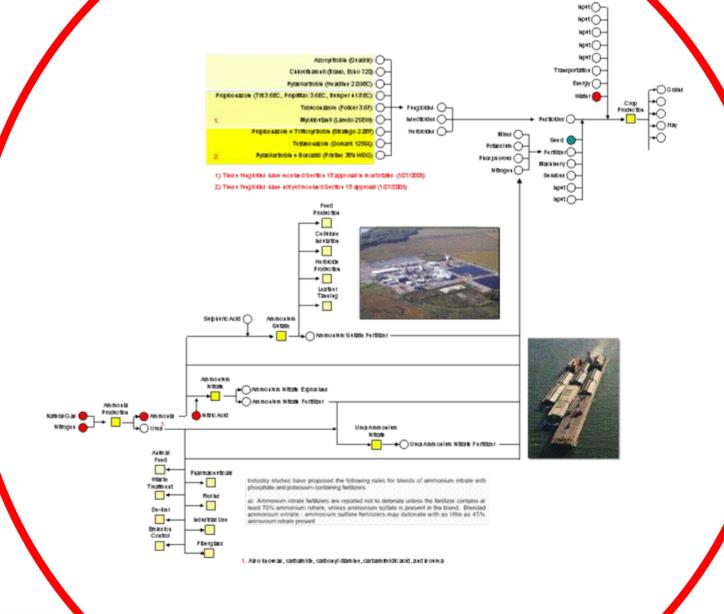
Soybean Rust Project
Soybean Input/Process/Output Diagram

Chemicals

Agricultural Dependencies On Other Infrastructures & Critical Assets

Photo credit: Bureau of Reclamation C45-300-20070.jpg

What is the primary purpose of Hoover Dam?

What is the secondary purpose of Hoover Dam?

Photo Credit: USACE

Starved Rock Lock & Dam
Illinois Waterway
River Mile 231
Utica, IL

USACE Image File 0993-38.jpg

Agricultural Dependencies On Other Infrastructures & Critical Assets

Image credit: Robert Taylor, CIP/DSS
Data: USACE, Navigation Data Center, Waterborne Commerce Statistics Center
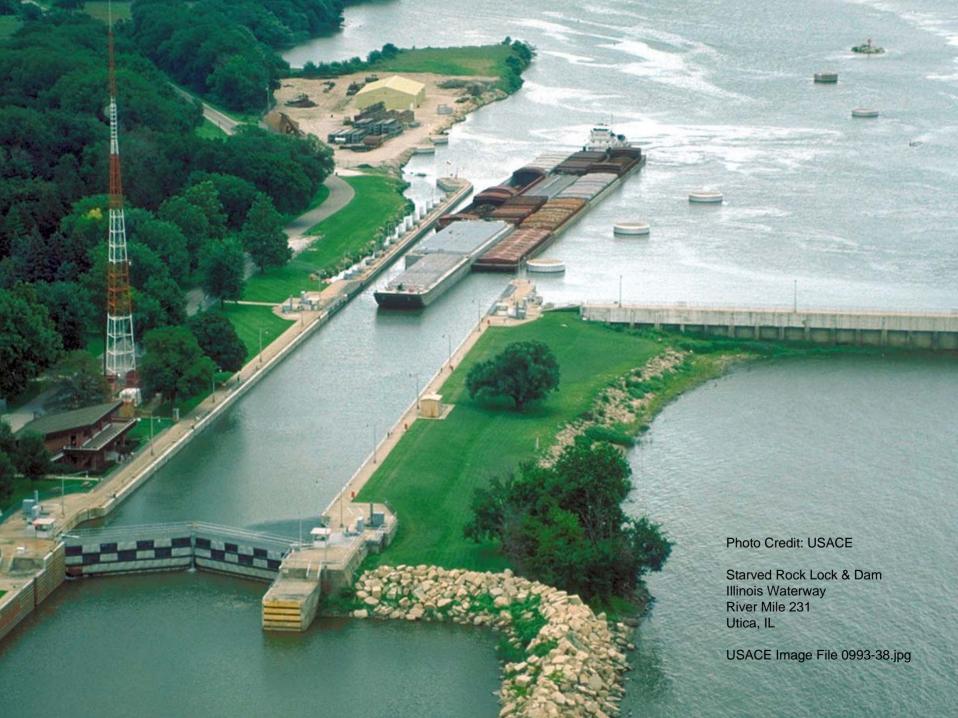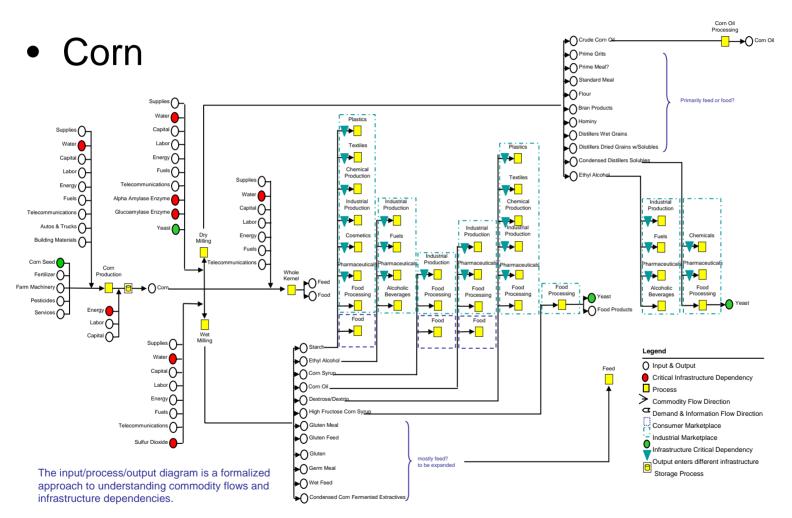
Agricultural Commodity Versus Food

- Corn

The input/process/output diagram is a formalized approach to understanding commodity flows and infrastructure dependencies.

Legend

○ Input & Output
● Critical Infrastructure Dependency
▢ Process
⟩ Commodity Flow Direction
⊃ Demand & Information Flow Direction
⬚ Consumer Marketplace
⬚ Industrial Marketplace
● Infrastructure Critical Dependency
▼ Infrastructure Critical Dependency
⬚ Output enters different infrastructure
▢ Storage Process

Version 11/3/2003 CIP/DSS

With Corn Prices Rising, Pigs Switch To Fatty Snacks

On the Menus: Trail Mix, Cheese Curls, Tater Tots; Farmer Jones's Ethanol Fix

By LAUREN ETTER
May 21, 2007; Page A1

GARLAND, N.C. -- When Alfred Smith's hogs eat trail mix, they usually shun the Brazil nuts.

Alfred Smith

"Pigs can be picky eaters," Mr. Smith says, scooping a handful of banana chips, yogurt-covered raisins, dried papaya and cashews from one of the 12 one-ton boxes in his shed. Generally, he says, "they like the sweet stuff."

Mr. Smith is just happy his pigs aren't eating him out of house and home. Growing demand for corn-based ethanol, a biofuel that has surged in popularity over the past year, has pushed up the price of corn, Mr. Smith's main feed, to near-record levels. Because feed represents farms' biggest single cost in raising animals, farmers are serving them a lot of people food, since it can be cheaper.

Besides trail mix, pigs and cattle are downing cookies, licorice, cheese curls, candy bars, french fries, frosted wheat cereal and peanut-butter cups. Some farmers mix chocolate powder with cereal and feed it to baby pigs. "It's kind of like getting Cocoa Puffs," says David Funderburke, a livestock nutritionist at Cape Fear Consulting in Warsaw, N.C., who helps Mr. Smith and other farmers formulate healthy diets for livestock.
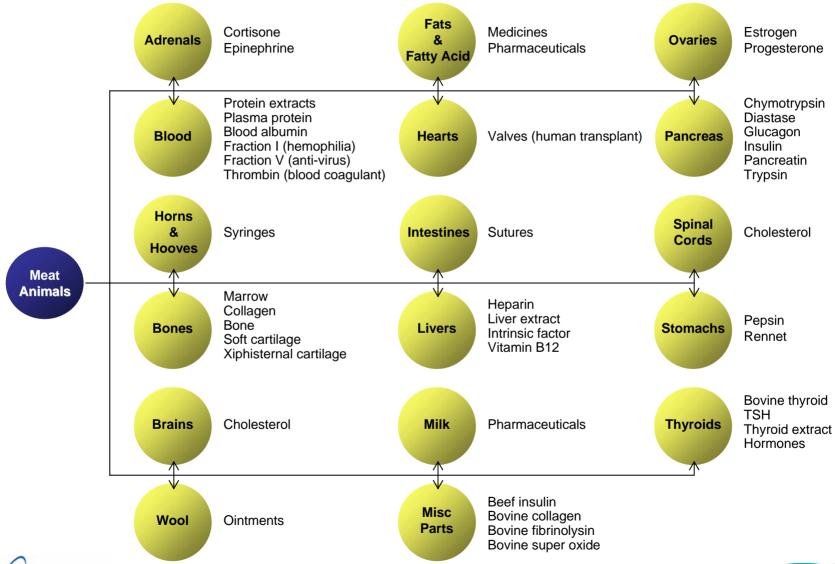
The Wall Street Journal

Medical Use of Agricultural Commodities

Meat Animals

Adrenals — Cortisone, Epinephrine

Blood — Protein extracts, Plasma protein, Blood albumin, Fraction I (hemophilia), Fraction V (anti-virus), Thrombin (blood coagulant)

Horns & Hooves — Syringes

Bones — Marrow, Collagen, Bone, Soft cartilage, Xiphisternal cartilage

Brains — Cholesterol

Wool — Ointments

Fats & Fatty Acid — Medicines, Pharmaceuticals

Hearts — Valves (human transplant)

Intestines — Sutures

Livers — Heparin, Liver extract, Intrinsic factor, Vitamin B12

Milk — Pharmaceuticals

Misc Parts — Beef insulin, Bovine collagen, Bovine fibrinolysin, Bovine super oxide

Ovaries — Estrogen, Progesterone

Pancreas — Chymotrypsin, Diastase, Glucagon, Insulin, Pancreatin, Trypsin

Spinal Cords — Cholesterol

Stomachs — Pepsin, Rennet

Thyroids — Bovine thyroid, TSH, Thyroid extract, Hormones

American Red Cross donor eligibility rules

- At this time, the American Red Cross donor eligibility rules related to vCJD are as follows:
- **You are not eligible to donate if**:
  From January 1, 1980, through December 31, 1996, you spent (visited or lived) a cumulative time of 3 months or more, in the United Kingdom (UK), or
- From January 1, 1980, to present, you had a blood transfusion in any country(ies) in the (UK). The UK includes any of the countries listed below.

  - Channel Islands
  - England
  - Falkland Islands
  - Gibraltar
  - Isle of Man
  - Northern Ireland
  - Scotland
  - Wales

You are not eligible to donate if…

- You were a member of the of the U.S. military, a civilian military employee, or a dependent of a member of the U.S. military who spent a total time of 6 months on or associated with a military base in any of the following areas during the specified time frames
  - From 1980 through 1990 - Belgium, the Netherlands (Holland), or Germany
  - From 1980 through 1996 - Spain, Portugal, Turkey, Italy or Greece.

- You spent (visited or lived) a cumulative time of 5 years or more from January 1, 1980, to present, in any combination of country(ies) in Europe, including in the UK from 1980 through 1996 as listed in above, on or associated with military bases as described above, and in other countries in Europe as listed below:

Albania
Austria
Montenegro (Federal Republic of Yugoslavia)
Belgium
Bosnia/Herzegovina
Bulgaria
Croatia
Norway
Poland
Czech Republic
Denmark
Romania
France

Slovak Republic (Slovakia)
Germany
Greece
Spain
Finland
Hungary
Ireland (Republic of)
Italy
Kosovo (Federal Republic of Yugoslavia)
Liechtenstein
Luxembourg
Macedonia
Netherlands (Holland)
Portugal
Serbia (Federal Republic of Yugoslavia)
Slovenia
Sweden
Switzerland
Turkey
Yugoslavia (Federal Republic includes Kosovo, Montenegro, and Serbia)

Does the Price of Coffee in Brazil Threaten Critical Infrastructure & National Security?

- Coffea Arabica L.

Things That Go Bump In the Night

Globalization

Terrorism

Photo credit: NASA

Mother Nature

Aelbert Cuyp, 1620-1691

http://www.sandia.gov/nisac/

Intellignostics

Real time, simple, multi-target pathogen detection

Intellignostics

Rapid multi-target detection technology

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Intellignostics
Rapid multi-target detection technology

Market Opportunity

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Intellignostics
Rapid multi-target detection technology

Market Opportunity

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Future Testing Opportunities

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Food

5

Future Testing Opportunities

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Food

Environmental

Intellignostics
Rapid multi-target detection technology

Future Testing Opportunities

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

Food

Environmental

Human Diagnostics

Intellignostics
Rapid multi-target detection technology

Future Testing Opportunities

A new technology providing
a simple, economical, very rapid real-time digital diagnostic device

| Food | Environmental | Human Diagnostics | Department of Defense |

intellignostics
Rapid multi-target detection technology

A Platform Technology

- **Human Diagnostic Testing**

-Non-viral pathogens such as
   Anthrax and other bacteria

- Viral pathogens such as HIV,
   Smallpox and SARS

- **Environmental Testing**

   - Bacterial diseases

   - BioWarfare Agents

Intellignostics
Rapid multi-target detection technology

IntelliProbe™ Technology

Manufacturing Costs

- Of instrument at scale: ~ $30

  - Of sensor at scale: ~ $1

    - Comparable to cell phone size/durability

      - Simple enough for anyone to use

        - Inexpensive enough to put in many hands

Intellignostics
Rapid multi-target detection technology

The Alternative

60 seconds!

Results

Take sample

Transmit data to decision-maker

Institute action

Intellignostics
Rapid multi-target detection technology

'Situation current', crisis ready, and adaptable

- "Universal" instrument and software

- Sensors will turn over in routine use and are easily updated

- Coverage
  - Routine triage targets

  - Pandemic disease targets

  - Biowarfare targets

Intellignostics
Rapid multi-target detection technology

Intellignostics' IP

Fundamental sensing method, U.S. Patent 5,932,953 issued August 3, 1999

- Other IP subject areas

  – Sensor coatings

  – Arrays of tests on single sensors

  – Captured target molecular signature

  – Sensor architecture

Current Team

Richard A. Van Deusen, DVM, MS, Founder and Principal Scientist

- Veterinarian, epidemiologist
- Instrumental in developing current state-of-the-art rapid neuraminidase plate test for sub-typing influenza viruses

Paul Knapp, CEO

- Twin City-focused venture capitalist with 1st quartile performance
- 24 portfolio companies

Intellignostics
Rapid multi-target detection technology

For more information contact:

Paul R. Knapp, Sr.
CEO

(651) 604-4204

pknapp@scvinc.com

Richard A. Van Deusen, DVM, MS

Founder & Principal Scientist

Intellignostics, Inc.

intellignostics@usinternet.com
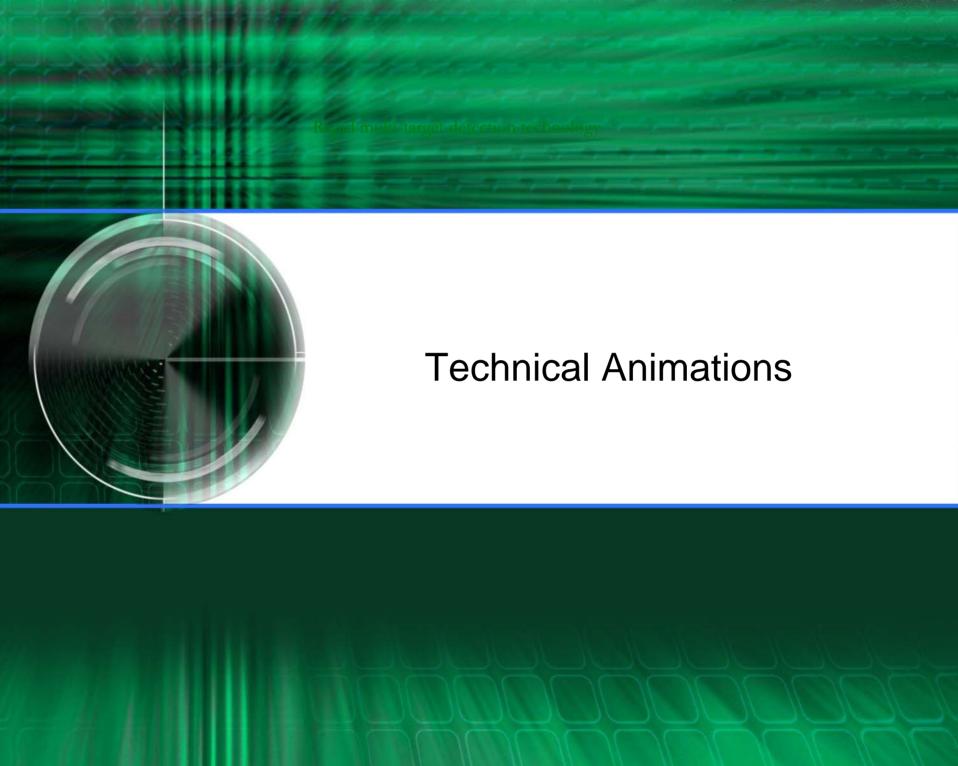
2380 Wycliff Street, Suite 100

St Paul, MN 55114

Phone: 651-659-0502

FAX: 651-659-0537

Intellignostics
Rapid multi-target detection technology

Technical Animations
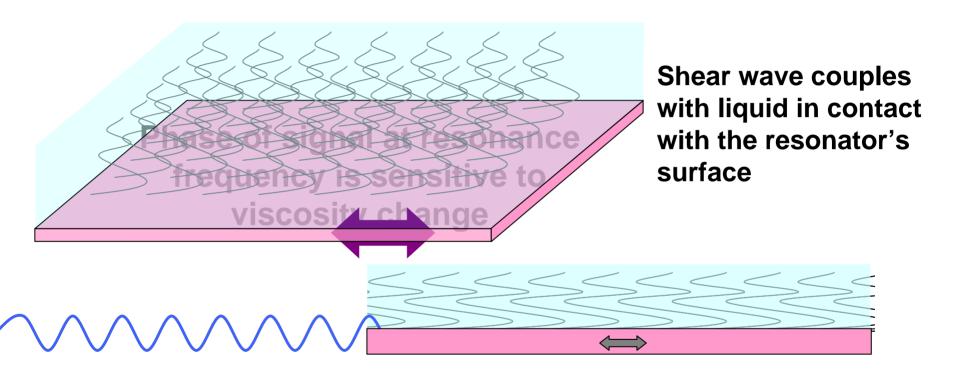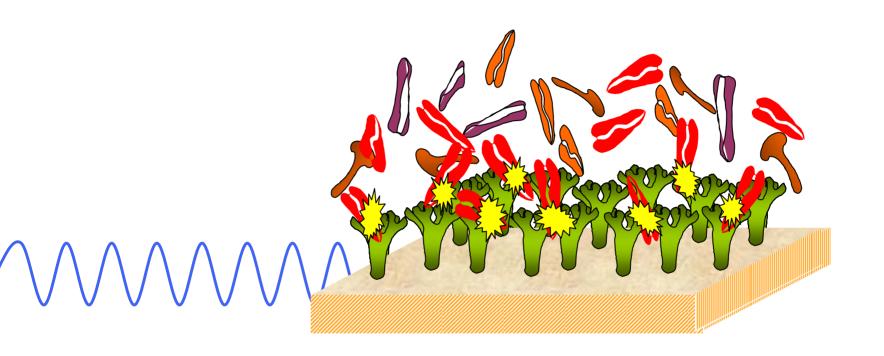
Operating Principle

RFPS™ Shear Wave Resonator

Shear wave couples with liquid in contact with the resonator's surface

Phase of signal at resonance frequency is sensitive to viscosity change

17
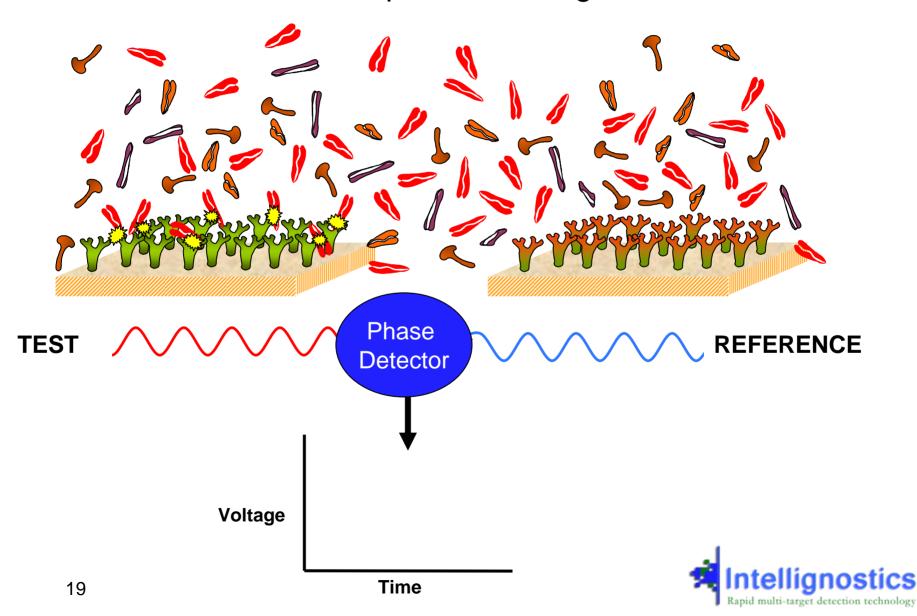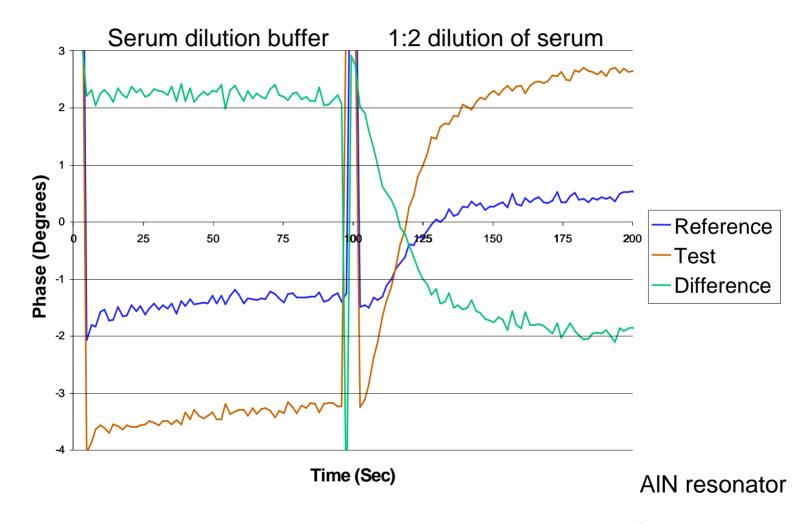
RFPS™ Operating Principle

How the Reference Simplifies Sensing

TEST **Phase Detector** **REFERENCE**

Voltage

Time

Intellignostics
Rapid multi-target detection technology

Protein-A Coated Sensor Response to IgG

AlN resonator

The Future of Diagnostic Testing

Intellignostics
Rapid multi-target detection technology

COUNTERSOL: SCALABLE CONTAINMENT & REMEDIATION
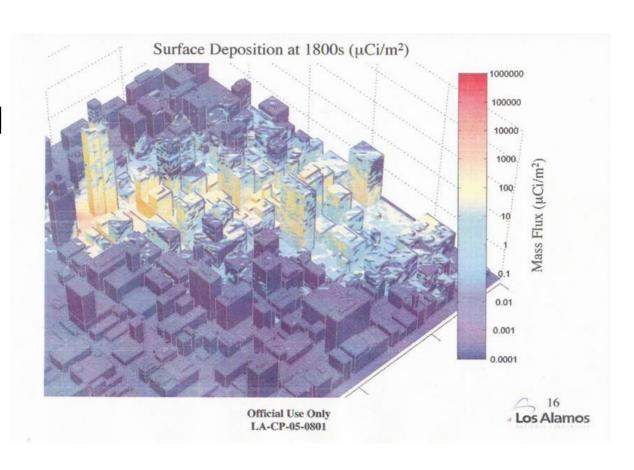
For
RADIOLOGICAL DISPERSAL DEVICES (RDDS)
& DIRTY BOMBS

Dr. Mark Krekeler

1

DIRTY BOMBS AND RDDS

- High Probability

- Radiological charges
  - $^{137}CsCl$
  - ^{60}Co
  - $^{90}SrTiO_3$

- Limited Options

Surface Deposition at 1800s ($\mu Ci/m^2$)

Mass Flux ($\mu Ci/m^2$)

1000000
100000
10000
1000
100
10
1
0.1
0.01
0.001
0.0001

Official Use Only
LA-CP-05-0801

16
Los Alamos

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SCIENCES, LLC

2

THE RDD THREAT

- UN's International Atomic Energy Agency (2004)
    - 300 confirmed cases trafficking (1993-2003).
    - 344 unconfirmed cases (1993-2003).
- Some related events
    - Moscow's Ismailovsky Park - 1995
    - 375 lbs of ^{137}CsCl seized in Ukraine May, 2004 (AP)
    - 66 pounds seized in Thailand 2003 (CNN)
- Exact amount of ^{137}CsCl in existence is arguable
    - ~3000 collective seed trucks missing in Soviet Union
    - Greensboro, N.C. 19 ^{137}Cs Rods missing never found

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3

CONTAINMENT & REMEDIATION OPTIONS

Performance	Time / Dilution	Water Rinse	Gel	Foam	Countersol
Cost	LOW	LOW	MED	HIGH	LOW
Availability	HIGH	HIGH	LOW	LOW	HIGH
Applicability	EASY	EASY	SPEC.	SPEC.	MODERATE
Disposal	N/A	LOW	MED	??	STABLE SOLID
Scaleability	N/A	HIGH	LOW	MED	HIGH
Shelf Life	N/A	N/A	??	??	>5 years

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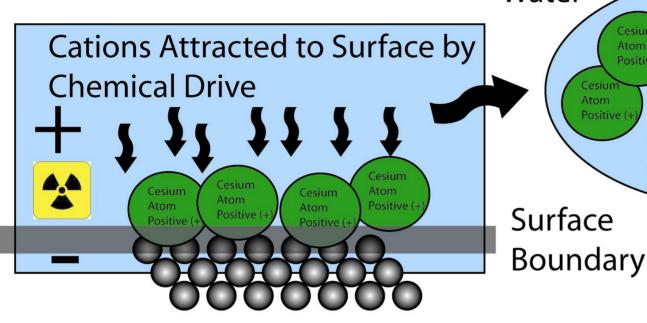
CONTAINMENT & REMEDIATION OPTIONS
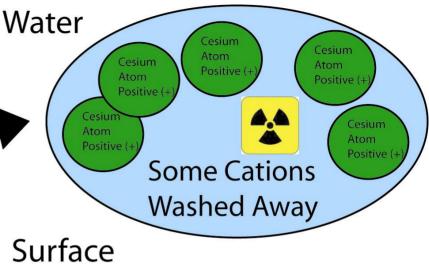
	Time / Dilution	Water Rinse	Gel	Foam	Countersol
Ionic Exchange	LOW	LOW	HIGH	HIGH	HIGH
Containment	LOW	LOW	HIGH	HIGH	HIGH
Remediation	LOW	LOW	HIGH	HIGH	HIGH
- ^{137}Cs	LOW	MED	HIGH	HIGH	HIGH
- ^{60}Co	LOW	MED	HIGH	HIGH	HIGH
- ^{90}Sr	LOW	MED	HIGH	HIGH	HIGH
Bio Friendly	N/A	HIGH	MED	LOW	HIGH

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5

Water Decon

Cations Attracted to Surface by Chemical Drive

Water

Some Cations Washed Away

Surface Boundary

Oxygen Atoms in Surface Have a Negative Charge (-)
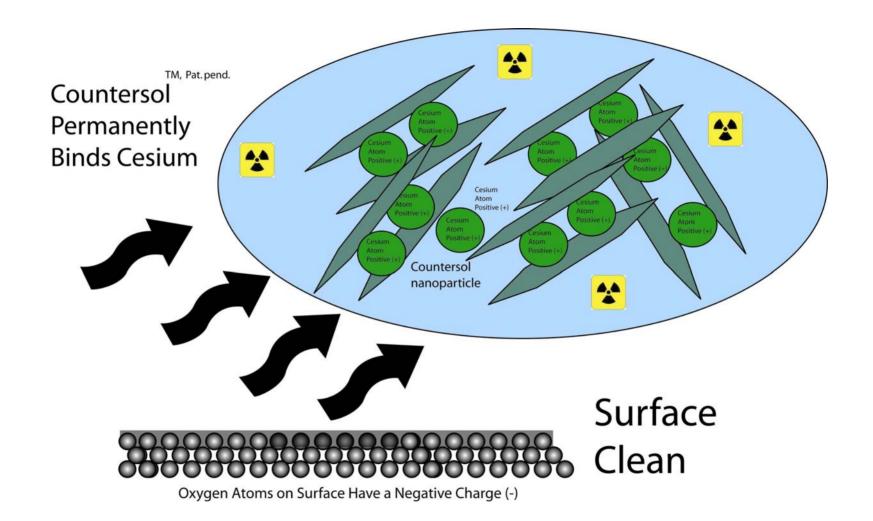
After Water Decon

Water Has
Evaporated

Chemical Equilibrium =
Permanently Radioactive
Surface

Surface
Boundary

Cesium Atom Positive (+)

Cesium Atom Positive (+)

Cesium Atom Positive (+)

Oxygen Atoms in Surface
Have a Negative Charge (-)

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7
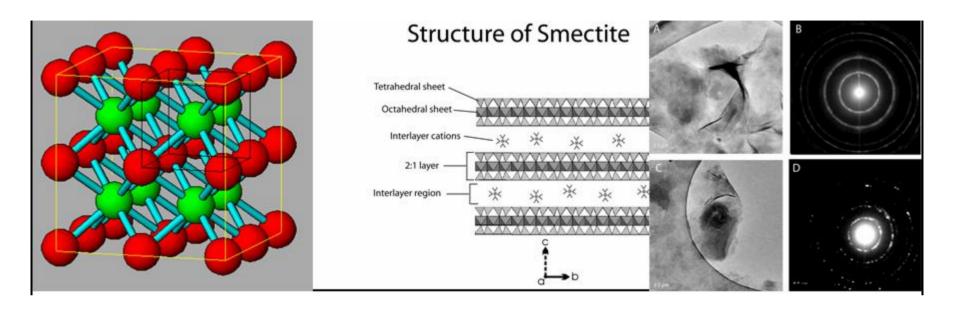
Countersol ™, Pat. Pend. Decon

Countersol ™, Pat. Pend. Decon

9
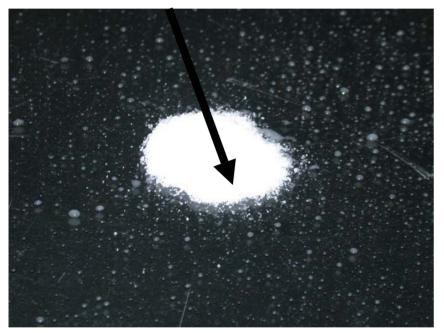
Countersol –
A Containment
and Remediation Technology

SPRAY MONTMORILLONITE SLURRY

~2.5 cm pile
of CsCl

Prevents Secondary
Dispersal

One time spray
-does not disrupt pile

20 - 30 sprays
isolate CsCl

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SCIENCES, LLC

11

FEATURES

- Aqueous suspension – pour or spray
- Expands and absorbs, penetrates porous structures
- Immediately and irreversibly sequesters cesium and other radioactive cations
- Absorbs radioactive chloride, carbonate and sequesters particulate oxides
- Complete scalability
- Ecologically friendly
- Made in the USA

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12
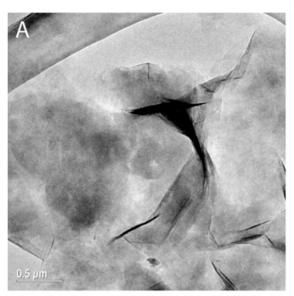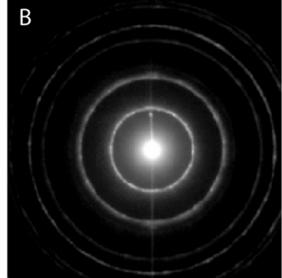
Image   Diffraction

Na-montmorillonite

(Starting)
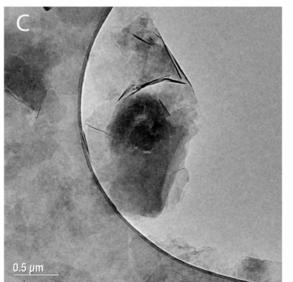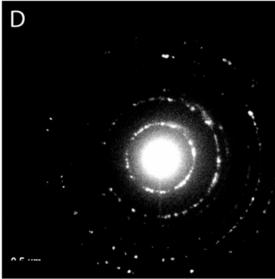
Cs-montmorillonite

(Ending)
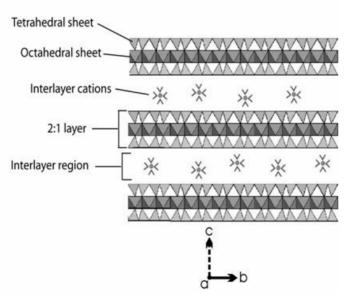
Reaction is spontaneous - limited only by the amount of nanomaterial present (always can add more)

Molecular structure preferentially exchanges sodium for cesium and all cations larger than Na

Structure of Smectite

Cs+

Na+

MINERAL SCIENCES, LLC

Countersol Demonstration

MINERAL
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SUMMARY

- Threat of Dirty Bomb and radiological contamination is real

- Current methods of decontamination are not fully effective

- Countersol[TM, Pat. Pend.] is a non-toxic, easily applied, total solution

- Alternative dispensing methods are available to match the assessed threats

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16

MINERAL SCIENCES CONTACT INFO

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  - 703-993-3484; Cell -- 703-409-9851
  - mark.krekeler@gmail.com
- Brad Zell
  - 410-384-9181; Cell -- 410-336-4272
  - Brad.Zell@teleport.com
- Gary Wm. Erickson
  - 651-340-7771; Cell -- 602-316-9015
  - gwmerickson@msn.com

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17

Heartland Security
2007 Conference & Exhibition
SBIR/STTR

Betsy Lulfs
Program Director

Know the Process
Know the People

Dr. Bill Coggin

Participating Agencies

SBIR/STTR

- DOD
- HHS
- NASA
- DOE
- NSF

SBIR

- USDA
- DOC
- EPA
- DOT
- ED
- DHS

positively *Minnesota*

Department of Employment
and Economic Development
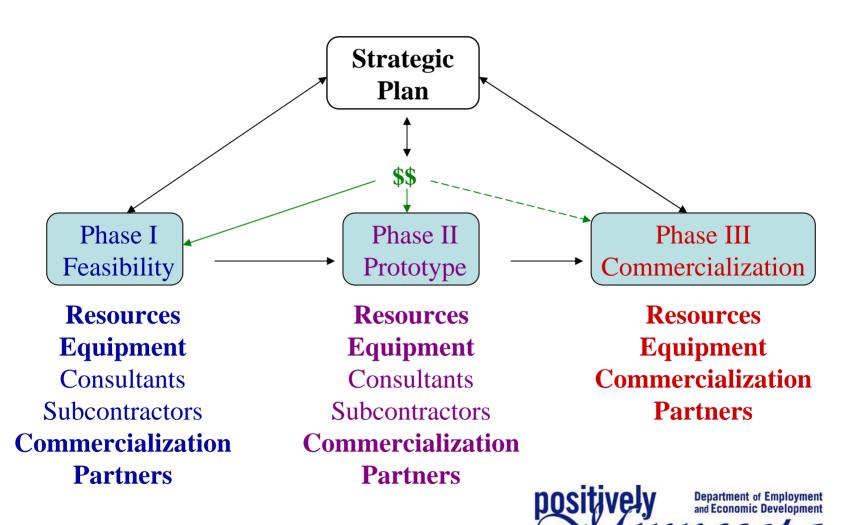
	DOD	NIH	NASA	NSF	DOE	DHS	EPA	DOT	DOC	ED	USDA
Jan	■	AIDS							■	■	
Feb											
Mar										■	
Apr	■	Omnibus				■					
May		AIDS					■	■			
Jun											
Jul	STTR										
Aug		Omnibus									
Sep		AIDS	■								■
Oct	■					■					
Nov		Contracts									
Dec		Omnibus		■	■						

positively *Minnesota*

Department of Employment and Economic Development

Big Picture

Grants vs. Contracts

Grants

- Broad topics
- Higher risk
- Funds good ideas
- You must determine what "good" is
- NIH, DOE, ED, USDA, NSF

Contracts

- Specific problem/ need
- You must grasp & respond to that need
- Opportunity for sole source Phase III
- DOD, NASA, DOT,NIH, DOC, EPA, HSARPA

Agency Differences

- **Contracting**
  - ➲ **Agency establishes plans, protocols, requirements**
  - ➲ **Highly focused topics**
  - ➲ **Procurement mechanism for DOD and NASA**
  - ➲ **More fiscal requirements**

- **Granting**
  - ➲ **Investigator initiates approach**
  - ➲ **You must determine what "good" is**
  - ➲ **Less-specified topics**
  - ➲ **Assistance mechanism**
  - ➲ **More flexibility**

DOD   NIH
NASA   ED
EPA   DOT
DOC

NIH   NSF   DOE
ED   USDA

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Department of Employment
and Economic Development

Potential Participants

- Any stage of business development; pre-seed; early; existing; joint ventures; strategic alliances

- Scientists/Engineers/Researchers

- Academia

- Large Corporations

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Department of Employment
and Economic Development

Questions to Ask Before Deciding to Participate

- Does winning enhance your corporate goals?
- Do you possess technical competence?
- Can you gain access to necessary resources?
- What agencies should you consider?
- What agency need/opportunity must you address?
- Do you have an innovative concept that is within the capabilities of your company & will guarantee profits and growth?

More Questions

- Where might you find Phase II matching funds? Phase III sources?

- What are the commercial applications? What's your competitive advantage? How would you get it to market?

- Are there other places to submit a related proposal? Is this the best program to submit your proposal?

Filtering Mechanism for Potential Investors

- Proposals are technically reviewed by experts

- Commercialization plan is reviewed and ranked

- A company's ability to conduct the project and deliver results are tested

- Skills of the management/technical team are evaluated

Important Points to Consider

- Producing a competitive proposal requires an investment of time and/or money

- A great idea is only the starting point

- The company must be willing to assess their firm's strengths and weaknesses, and be able to shore up the weaknesses

- Credibility as a proposer is a key factor

Do Your Homework

- Contact the SBIR/STTR agency reps
- Search the web for your <u>competition</u>
- Thoroughly search the literature
  - Your own field of expertise
  - Alternative technical areas
  - Key application areas
  - Potential market opportunities
  - The patent situation
  - Your COMPETITION

Mark Henry TechBizSolutions, Inc.

Scheduling the Proposal Writing Preparation Process

- Right Way
  - Have corporate goals established to guide what proposals should be written
  - Contact agencies to determine compatibility of *their* SBIR/STTR program and *your* goals
  - Develop relationships with agencies
  - Establish relationships with potential subcontractors, strategic partners, commercialization partners
  - Monitor agency websites for delays, changes in topic lists, instructions, etc.

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Scheduling the Proposal Writing Preparation Process

- ## What Usually Happens
  - Suddenly remembers, 15 days before due date that solicitation is open
  - Picks topics that looks like "fun"
  - Calls subs and/or university 10 days before due date to determine interest & get commitment letter
  - "Wing it," since couldn't talk to TPOC
  - Do all-nighter(s) to finish
  - Submit electronically 37 minutes before deadline and pray proposal will get thru
  - Learn 6 months later topic was withdrawn before proposal due date

Some Relevant Minnesota Statistics: *Equity Financing*

❖ The 30 Venture Funded firms in the State have been in receipt of 288 SBIR/STTR Awards

❖ Total SBIR-STTR Dollars to date = $92,136,964

❖ Total VC Funding received by these 30 firms: $228 Million

positively Minnesota

Department of Employment and Economic Development

U.S. Companies Receiving Early-Stage Financing

- Apple Computer
- Chiron
- Compaq
- Intel
- Symantec

Potential Benefits for Qualifying Small Businesses
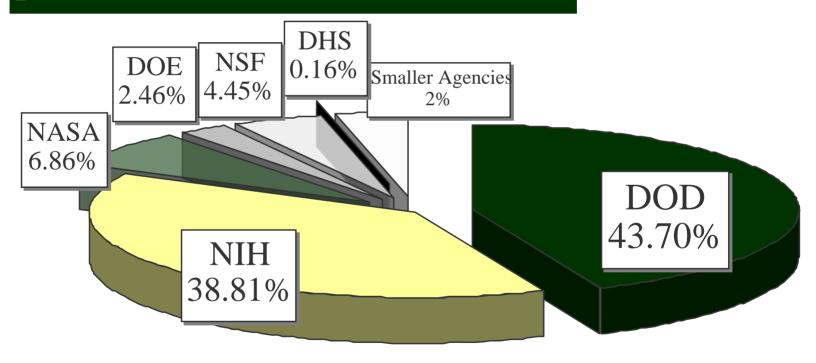
- No repayment of funds
- Small businesses are increasingly recognized as a principal source of technological innovation
- Fosters partnerships (i.e. large corporations, academia)
- Stimulates local & state economies

Potential Benefits for Qualifying Small Businesses

- Provides seed money to fund high-risk R&D

- Provides recognition, verification & visibility

- Potential leveraging tool to attract investors & other sources

- IP rights are retained by the small business

Minnesota Distribution of SBIR-STTR Dollars by Agency 1983-present (June 2007)

DOE 2.46%

NSF 4.45%

DHS 0.16%

Smaller Agencies 2%

NASA 6.86%

DOD 43.70%

NIH 38.81%

Created by Innovation Development Institute

positively *Minnesota*

Department of Employment and Economic Development
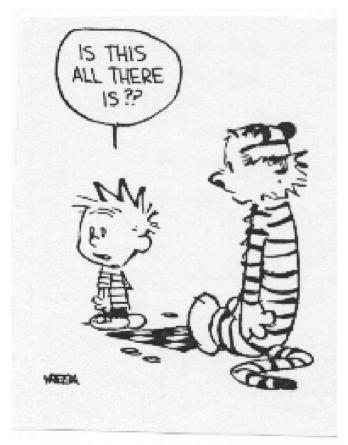
Think about the SBIR & STTR programs as the R&D budget to develop products that fit within the strategic mission of the small business.

The End

Food Protection & Defense

▲ Safety of the food supply is of critical importance

▲ The food industry as a target

▲ How can we learn from the past

▲ How can we better prepare for the future

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Headlines On Recent Outbreaks

Supplier Expands Beef Recall Over Concerns of E. Coli Contamination
ASSOCIATED PRESS: NY Times, June 10, 2007

Toxic carrot juice paralyzes 2 in Toronto
CBC News October 9, 2006

Pet Food Recall Expanded to New Wet Food Brand
FoxNews: SUNDAY, APRIL 01, 2007

China shuts 180 food factories for using illegal chemicals
Associated Press, June 27, 2007

Another norovirus outbreak docks ship
World's largest cruise ship held in port to undergo intensive cleaning
MSNBC: Associated Press Dec 11, 2006

Salmonella Cases in Peanut Butter Top 600
CNN.com

Investigators trace spinach E. coli to cattle ranch in California
Associated Press: Minneapolis Star Tribune, March 23, 2007

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Food Safety versus Food Defense

Food Safety
- Unintentional
- Routine
- Real
  - 76 million foodborne illnesses
  - 325,000 hospitalizations
  - 5,000 deaths

Food Defense
- Intentional
- Criminal
- Sporadic
- Plausible
- Unknown

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What is Food Terrorism?

An act or threat of deliberate contamination of food for human consumption with chemical, biological, or radionuclear agents for the purpose of causing injury or death to civilian populations and/or disrupting social, economic or political stability.

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Who are we concerned about?

- Disgruntled employees

- Violent activist groups

- Criminals / subversives

- International / government supported or directed groups or individuals

Why are we concerned about food terrorism?

Encyclopedia of Jihad
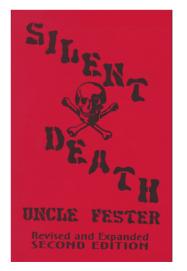
▲ No specific targeting information indicating attack on food supply is imminent

▲ Intelligence indicates that terrorists have discussed components of food sector

▲ Manuals for intentional contamination of food are widely available

The Poisoner's Handbook, found in Kabul

Slide credit: IFT

Why are we concerned about food terrorism?

▲ Potential for significant economic and psychological damage
  ■ Food sector = $1.24 trillion/year

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Why are we concerned about food terrorism?

▲ Potential for significant economic and psychological damage
 ■ Food sector = $1.24 trillion/year

▲ Efficient food distribution = potential for mass casualties

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Supply Chain Complexity
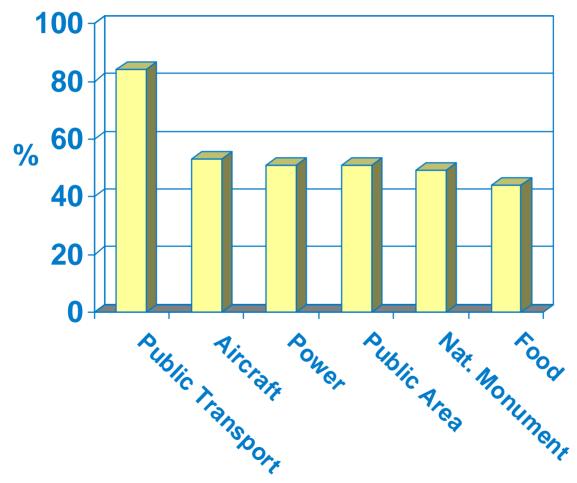
Why are we concerned about food terrorism?

- Potential for significant economic and psychological damage
  - Food sector = $1.24 trillion/year

- Efficient food distribution = potential for mass casualties

- Food chain complexity makes it hard to protect
  - 2,128,000 farms
  - 29,000 food manufacturing sites
  - 224,300 retail food stores
  - 565,000 food service outlets

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Slide credit: IFT
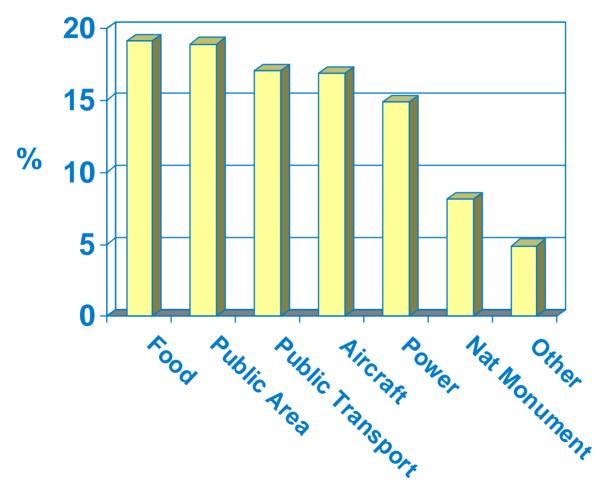
Percent of US residents expecting a serious terrorist act in the next 4 years

Source: Stinson, Kinsey, Degeneffe and Ghosh, 2006. www.hsaj.org/?fullarticle=3.2.3

Percent of anti-terrorism spending US residents believe should be allocated

Source: Stinson, Kinsey, Degeneffe and Ghosh, 2006. www.hsaj.org/?fullarticle=3.2.3

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Minnesota heritage linked to Food Industry

Pillsbury A. Mill, Arch Bridge and Mississippi River, Minneapolis, Minn.

Heartland Food Safety & Technology Companies – Today

Food Research In the Heartland

About Ecolab

- Leading global provider of cleaning, sanitizing, food safety and infection prevention products and service

- 23,000 associates

- Global reach – 160 countries

- $5 billion sales in 2006

ECOLAB®

Solutions and Services that Deliver Cleaner, Safer, Healthier

Foodservice/ Hospitality

Food & Beverage Processing

Healthcare/ Infection Control

Global Customer Relationships
400,000+ Customers

What can we learn from past incidents?

Unintentional Foodborne Outbreaks provide insight to

▲ Vulnerable foods

▲ Vulnerable points in their production

▲ Potential magnitude of public health impact

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Slide credit: IFT
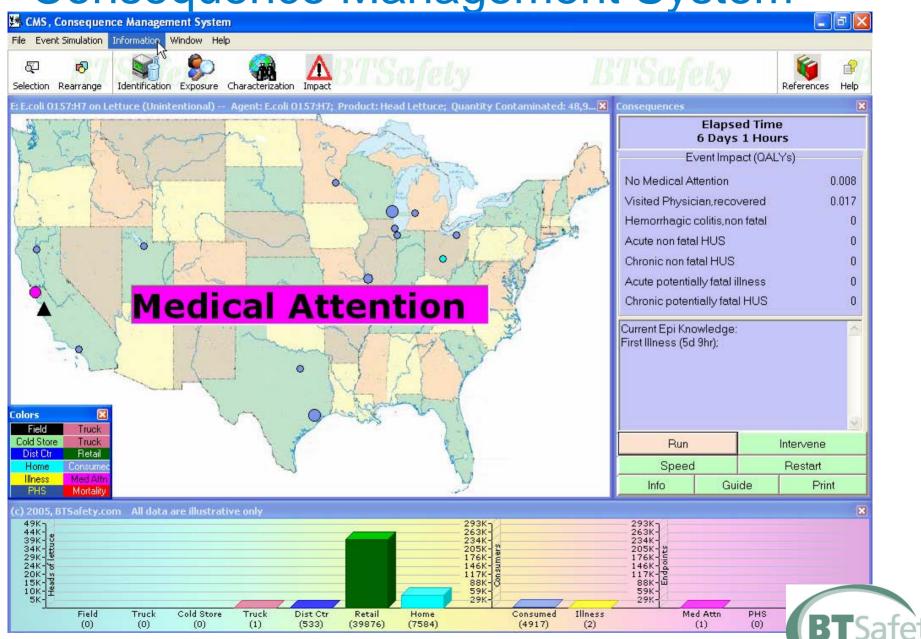
Unintentional Foodborne Outbreaks

- Norwalk like virus in bakery items with frosting, 1982
  - **3,000** people ill

- Pesticide (endrin) poisoning of contaminated flour, 1960s
  - **800** ill in the Middle East

- *Salmonella* Enteritidis in ice cream
  - Single facility, 1994
  - Estimated **224,000** affected
  - 30% required hospitalization

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Consequence Management System

What can we learn from intentional attacks on our food supply?

Slide credit: IFT

Intentional attacks

- 1984: Oregon – Rajneesh cult
  - *Salmonella* placed in multiple salads bars at restaurants, attempt to sway results of a local election
  - **751** ill, **45** hospitalized

- Oct. 1996: *Shigella dysenteriae* Type 2
  - Lab employee used microbes grown in-house to contaminate pastries served to 45 co-workers
  - **12** ill, **4** hospitalizations

Threat as a Weapon

- 1989: Chile – terrorist group

  - Phone call to the U.S. Embassy in Santiago claiming to have contaminated Chilean grapes with cyanide

  - FDA found 3 suspicious grapes in Philadelphia

  - Ruined the crop and Chilean fruit sales for an entire season, at a cost of $200+ million

  - Consumer confidence slow to return

  - Lasting harm to image of imports

Slide credit: IFT

Intentional attacks – Counterfeiters and Diethylene Glycol - DEG

▲1990 – Bangladash - 300+ children died from DEG contaminated cough syrup

▲1996 – Haiti - 85 children died from DEG contaminated cough syrup

▲Oct. 2006 – Panama - over 100 deaths from DEG in sugarless liquid expectorant
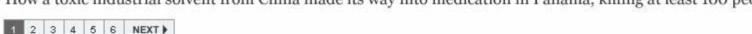
Diethylene glycol sold as glycerin…..

E-MAIL | FEEDBACK

A Poison's Path

How a toxic industrial solvent from China made its way into medication in Panama, killing at least 100 people.

1 | 2 | 3 | 4 | 5 | 6 | NEXT ▶

In a small factory in China, a syrup containing diethylene glycol, a toxic industrial solvent and prime ingredient in some antifreeze, was sold as glycerin, a more expensive syrup used in food and drugs.

CHINA

Beijing

Hengxiang

Shanghai

The Taixing Glycerine Factory's facility.

Du Bin for The New York Times

A dramatically different building is advertised on its website.

The New York Times

ECOLAB

Sold to Beijing broker who shipped to Shanghai….

E-MAIL | FEEDBACK

A Poison's Path

How a toxic industrial solvent from China made its way into medication in Panama, killing at least 100 people.

| 1 | 2 | 3 | 4 | 5 | 6 | NEXT ▶ |

CHINA

Beijing

Hengxiang

Shanghai

It was sold to a Beijing broker, CNSC Fortune Way Company, which shipped it out of a port near Shanghai.

The New York Times
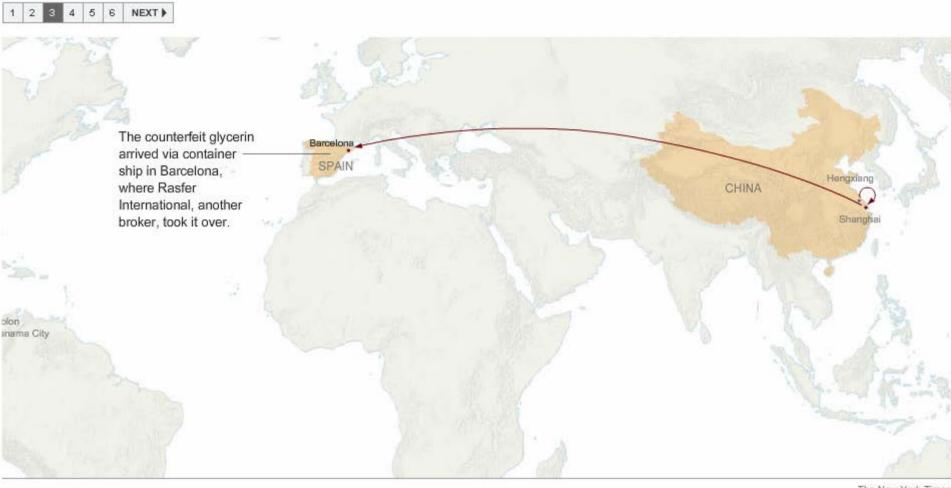
Counterfeit glycerin arrives in Barcelona…..

A Poison's Path

How a toxic industrial solvent from China made its way into medication in Panama, killing at least 100 people.

| 1 | 2 | 3 | 4 | 5 | 6 | NEXT ▶ |

The counterfeit glycerin arrived via container ship in Barcelona, where Rasfer International, another broker, took it over.

Barcelona

SPAIN

CHINA

Hengxiang

Shanghai

olon
inama City

The New York Times

ECOLAB

Brokers certificates claim 99.5% glycerin…..

Barcelona certification

Beijing certification

Original certificate of analysis

46 barrels arrive in Panama…..

MAY 6, 2007

✉ E-MAIL | FEEDBACK

A Poison's Path

How a toxic industrial solvent from China made its way into medication in Panama, killing at least 100 people.

| 1 | 2 | 3 | 4 | 5 | 6 | NEXT ▶ |

Medicom, a broker in Colón, received 46 barrels of the poisoned syrup.

Barcelona
SPAIN

Colón
Panama City
PANAMA

The New York Times

EC✦LAB

Government packs it into 260,000 bottles…..

✉ E-MAIL | FEEDBACK

A Poison's Path

How a toxic industrial solvent from China made its way into medication in Panama, killing at least 100 people.

1 | 2 | 3 | 4 | 5 | 6 | NEXT ▶

The syrup was trucked to Panama City, where government officials used it in 260,000 bottles of medicine. At least 100 people were killed by the medicine.

Hundreds of unopened bottles of toxic medicine still remain in boxes at a Panama hospital.

Colon
Panama City

PANAMA

The New York Times

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Intentional attacks – Counterfeiters and Diethylene Glycol - DEG

- 1990 – Bangladash - 300+ children died from DEG contaminated cough syrup

- 1996 – Haiti - 85 children died from DEG contaminated cough syrup

- Oct. 2006 – Panama - over 100 deaths from DEG in sugarless liquid expectorant

- June 2007 – phony Colgate toothpaste imported from China contains DEG

"death sentence to former pharmaceuticals control officer in China…"
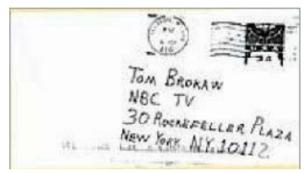
Even ineffective attacks cause significant economic and psychological damage …

- **Anthrax in the mail – 2001**
  - 22 cases, 5 deaths
  - 2 million people unnecessarily on Cipro **cost $1 billion**
  - Congress gave USPS **$1 billion** for *initial* interventions
  - USPS direct costs **>$3 billion**

How can we better prepare for the future?

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The Ecolab Research
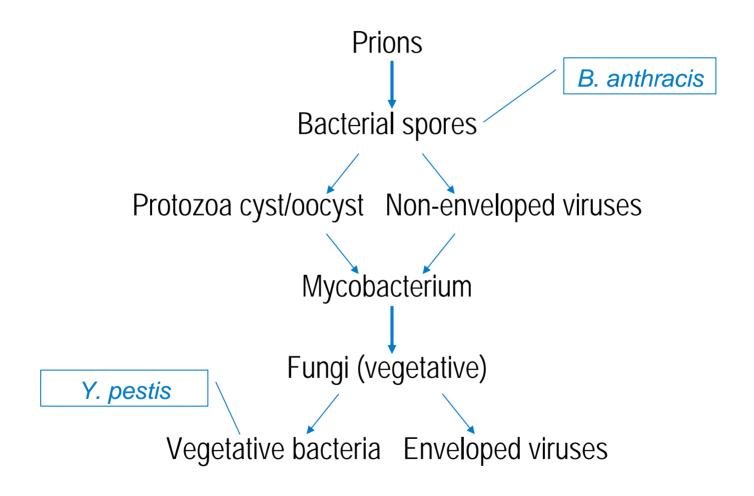
NATIONAL CENTER FOR
FOOD PROTECTION AND DEFENSE
A HOMELAND SECURITY CENTER OF EXCELLENCE

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Resistance to Biocides

Prions

Bacterial spores

B. anthracis

Protozoa cyst/oocyst   Non-enveloped viruses

Mycobacterium

Fungi (vegetative)

Y. pestis

Vegetative bacteria   Enveloped viruses

Biocide Efficacy

Organism type	Example indicator organisms	Product Classification
Bacterial spores	*Bacillus subtilis* *Clostridium sporogenes*	Sterilant High-level disinfectant
Vegetative bacteria	*Pseudomonas aeruginosa* *Staphylococcus aureus* *Salmonella choleraesuis*	Disinfectant Sanitizer

Study Variables

Time
- 10 and 30 minutes

Temperature
- 10, 20, or 30°C

Food
- None (water)
- 10% Flour paste
- Whole milk
- 50% Egg yolk emulsion
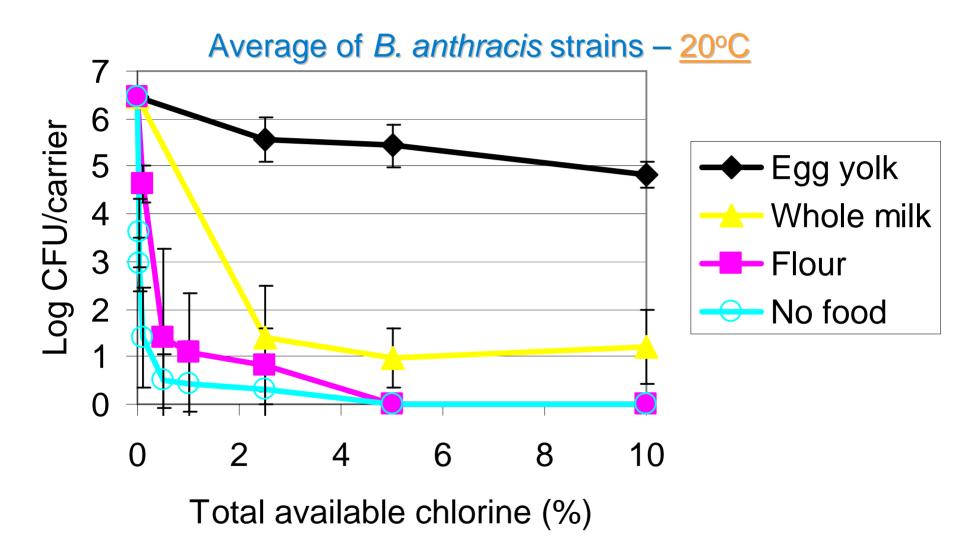
Organisms
- *B. anthracis*
- *Y. pseudotuberculosis*

Biocides*
- Sodium hypochlorite
- Quaternary ammonium compound (QAC)
- Iodophor
- Hydrogen peroxide
- Peroxyacetic acid
- Acidified sodium chlorite
- Peroxy/fatty acid sanitizers

*In 500 ppm hard water, no pH adjustment

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Sodium hypochlorite – 10 minutes

Average of *B. anthracis* strains – 20°C

Legend:
- ◆ Egg yolk
- ▲ Whole milk
- ■ Flour
- ○ No food

X-axis: Total available chlorine (%)
Y-axis: Log CFU/carrier

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Needed Biocide concentration for 6-log reduction, 30 minute

B. anthracis spores

	No food			Flour paste			Whole milk			Egg-yolk		
	$10^{\circ}C$	$20^{\circ}C$	$30^{\circ}C$	$10^{\circ}C$	$20^{\circ}C$	$30^{\circ}C$	$10^{\circ}C$	$20^{\circ}C$	$30^{\circ}C$	$10^{\circ}C$	$20^{\circ}C$	$30^{\circ}C$
Sodium hypochlorite	2300	2300	900	5700	4600	1700	23000	9600	9500	48000	48000	40000
Acidified sodium chlorite	5900	1500	1100	5700	2200	1200	N	5800	2300	N	N	N
Hydrogen peroxide	25%	14%	8.9%	25%	13%	6.4%	25%	13%	6.4%	24%	13%	7.6%
Iodophor	N	N	N	N	N	N	N	N	N	N	N	N
Quaternary	N	N	N	N	N	N	N	N	N	N	N	N
Mixed peroxyacids	2100	1500	500	4200	1800	900	9200	3900	2100	26000	16000	9500
Peroxyacetic acid	14000	8000	2300	1500	7500	2300	13000	7900	3200	18000	11000	3700

"N" - undiluted biocide did not achieve a 6-log reduction

NOTE: Concentrations are all above allowable labeled use

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Inactivation research summary

- ▲ Biocide efficacy
  - ■ QAC and iodophors not effective for *B. anthracis*
  - ■ Sodium hypochlorite, acidified sodium chlorite, hydrogen peroxide, peroxyacetic acid, and mixed peroxy acid biocides may inactivate *B. anthracis* spores on hard surfaces at concentrations well above EPA label

ECOLAB®

Inactivation research summary

- Biocide efficacy
  - QACs and iodophors not effective vs. B. anthracis
  - Sodium hypochlorite, acidified sodium chlorite, hydrogen peroxide, peroxyacetic acid, and mixed peroxy acid biocides may inactivate B. anthracis spores on hard surfaces at concentrations well above EPA label

- To use an EPA registered product in a manner inconsistent with its labeling.
  - Solution strength must be according to label
  - Applications must be on the label

- For a manufacturer to make real or implied claims for efficacy against organisms which are not on the label.

IT IS A VIOLATION OF FEDERAL LAW

ECOLAB

Inactivation research summary

- Biocide efficacy
  - QAC and iodophors not effective for *B. anthracis*
  - Sodium hypochlorite, acidified sodium chlorite, hydrogen peroxide, peroxyacetic acid, and mixed peroxy acid biocides may inactivate *B. anthracis* spores on hard surfaces at concentrations well above EPA label

- Inactivation dramatically reduced in colder environments and in the presence of food residues

- Work needs to continue for other potential agents

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More work needs to be done……

- ▲ Rapid detection methods

- ▲ Systems to improve traceability

- ▲ Communication
  - ■ Technical information available for rapid response
  - ■ Risk communication to minimize damage and panic

- ▲ Recovery tools and education

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Food Protection & Defense

- **There is a real threat**

- **Consequences would be devastating**

- **We need to:**
  - Continue research
  - Strengthen partnerships
  - Reinforce response networks

ECOLAB®

Food Protection & Defense

Ecolab is proud to be a partner with our valued customers and the National Center for Food Protection and Defense

- ◢ **There is a real threat**

- ◢ **Consequences would be devastating**

- ◢ **We need to:**
  - ▪ Continue research
  - ▪ Strengthen partnerships
  - ▪ Reinforce response networks

ECOLAB®

Near Space Communications Systems

Heartland Security Conference
Minneapolis, Minnesota

11 July 2007

Jerry Quenneville
Vice President, Business Development
Space Data Corporation
460 South Benson Lane
Chandler, Arizona 85224
(480) 722-2100
www.spacedata.net

Space Data
CORPORATION

Overview

Space Data produces high-altitude communications platforms that:

- Provide emergency response communications within 30 minutes and coverage over hundreds of miles within 2 hours

- Require minimal or no infrastructure, a capability that's critical in post-disaster scenarios and remote locations

- Support voice, data and asset tracking

- Have been in commercial operation for more than 3 years and are now being purchased in quantity by the U.S. Air Force

- Are cost-effective, recoverable and immediately available

- Can be tailored to users' specific needs and support interoperability

Space Data CORPORATION

What We Do

SkySite® Platform at 100,000 ft

Fill gaps in terrestrial wireless networks providing ubiquitous coverage to
   1) enterprises operating in rural areas,
   2) wireless service providers, and
   3) government agencies
for services and products including:

Services

Products

M2M / Telemetry
Short Messaging
Wireless E-mail
Voice
Broadband

Modems
GPS Trackers
PDAs
Handsets

Space Data
CORPORATION

The Solution Simply Integrates 3 Proven Technologies

- Integrated with proprietary altitude / network control & logistic systems

Weather Balloons

Ever Shrinking Wireless Devices

1990: 1365 grams
Single Ch. Analog Radio

93% Weight Reduction over 15 yrs. + more functions

2005: 95 grams
3 bands + Bluetooth + + MP3 + TV + Organizer + GPS +Mpixel Camera

GPS Network

+

+

- **20-Mile Altitude**
- **A Century of Experience**
- **Simple Logistics**
- **All Weather Operations**
- **FAA Acceptance of two 6 lb payloads**

- **Base Station Radios are also Shrinking**
- **(i.e. Picocells and Femtocells)**
- **Expendable**
- **Infrastructure keeps pace with Moore's Law**
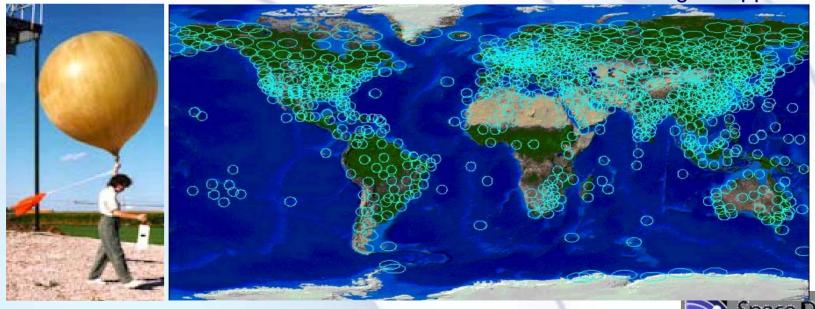
- **Precise Timing**
- **Location**
- **Inexpensive**

Space Data CORPORATION

Weather Balloons: over 80 Years of Reliable Launch Experience with Worldwide Coverage

- 880 worldwide sites launch 2X / day at noon / midnight
- Over 800,000 launches / yr with no incidents of Aircraft Damage
- FAA rules permit unmanned use in National Air Space (NAS) if:
  - 1) Total payload mass suspended from balloon < 12 lb
  - 2) Each payload package must be < 6 lbs
  - 3) Payloads must separate with 50 lb force
- FAA Regulations bar winged UAVs from NAS
  - Est. will take more than a decade and more than $400 M to gain approval
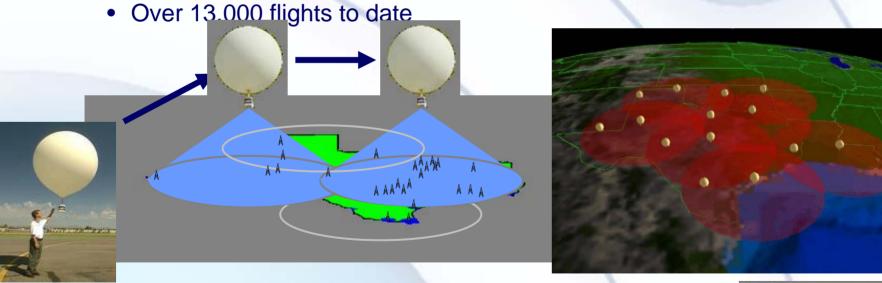
Developing a UAS collision-avoidance system will be a more complex task than the development of TCAS. It took the aviation community more than a decade and about $400 million to develop TCAS, notes Andrew Lacher, Mitre Corp. UAS program lead. Aviation Week 2-21-07

Space Data CORPORATION

Space Data's Coverage Solution

Our network consists of transceivers on weather balloons at 100,000 feet

- **A single *SkySite®* covers everything under a 420-mile diameter circle**
  - Single SkySite = 300 terrestrial towers
- **Only 41 M2M or 200 Voice SkySites needed to cover the entire US**
- **Uses industry standard protocols:**
  - Interoperates with existing carriers who utilize towers
  - Interoperates with existing user devices
- **In 24 x 7 operations for the past 39 months**
  - Over 180,000 flight-hours of cumulative near-space operations
  - Over 13,000 flights to date
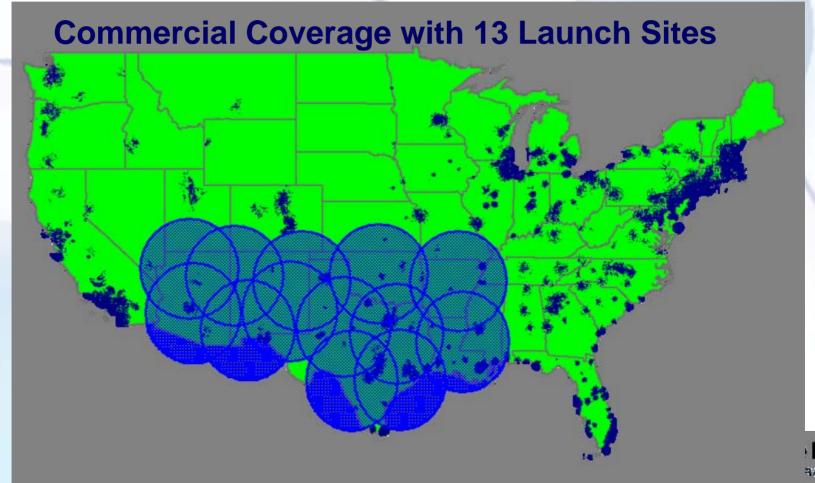
Each SkySite rises to 100,000 feet and levels off. In the uniform winds at that altitude, a constellation of interlocking SkySites float in unison to blanket large regions with coverage. New SkySites are launched every 12-24 hours to replace the previous constellation which is taken down, recovered and reused.

Space Data
CORPORATION

Space Data's Commercial Machine-to-Machine Network

- **Full Constellation provides ubiquitous coverage to > 20% of CONUS**
- **Tower-based urban coverage provided through roaming to SkyTel**
- **In operation for over 3 years focused on oil and gas markets**
- **Over 13,000 flights, over 180,000 flight hours, over 85% recovery rate**

Commercial Coverage with 13 Launch Sites

Types of Near Space Platforms

Platforms

Tethered Aerostats
- Limited mission envelope
- Already militarily exploited

Free-Floating Weather Balloon
- Limited mission envelope
- Already exploited

Altitude Control, Free-Floating Weather Balloon
- Moderate mission envelope
- Technology commercially mature and military deployment imminent

Altitude Control, Free-Floating Hi-Altitude Balloon
- Moderate mission envelope
- Limited military exploitation

Station-Keeping Hi-Altitude Airship
- Broad mission envelope
- Technology not mature

Low Risk Low Payoff ← **Continuum of Near-Space Assets** → **High Risk High Payoff**

Recovery Method		
Tethered Descent	Parachute Descent Controlled Parachute Descent Parafoil Descent Glider Descent	Controlled Platform Descent
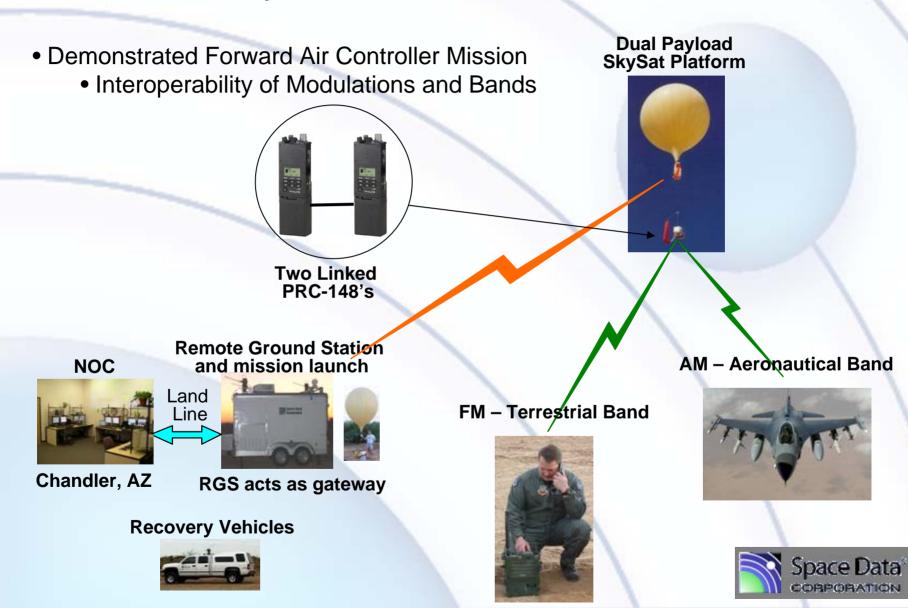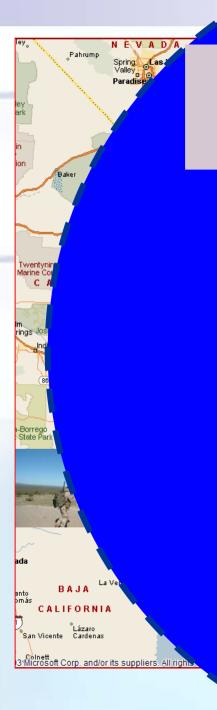
Space Data CORPORATION

Courtesy of Air Force Space Battle Lab
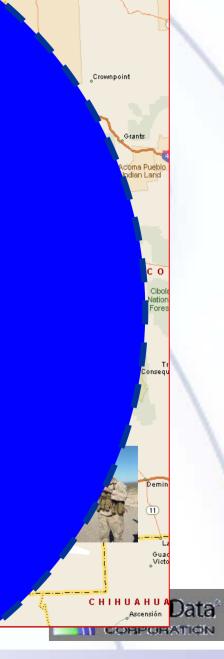
Combat SkySat Demonstration, March 2005

- Demonstrated Forward Air Controller Mission
  - Interoperability of Modulations and Bands

Dual Payload SkySat Platform

Two Linked PRC-148's

NOC

Chandler, AZ

Land Line

Remote Ground Station and mission launch

RGS acts as gateway

Recovery Vehicles

FM – Terrestrial Band

AM – Aeronautical Band

Space Data CORPORATION

Combat SkySat
Demo: March '05

Graphic courtesy of Air Force Space Battlelab

JEFX 06 Mar 06 Spiral II Comms between Phoenix, Nellis AFB, and Coronado Island
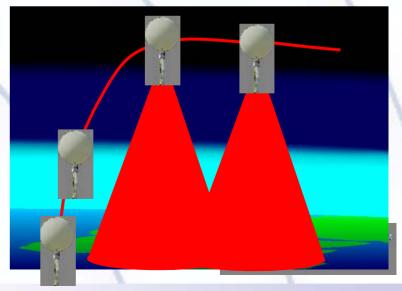
Near Space Communications System (NSCS)

- Deployment contract with USAF
  - $49 M / 5 year IDIQ Contract
  - Awarded Aug. 2006
  - Free-floating Balloons
    - Comm Relay – secure voice/data
    - "Truck" to carry lower 6-pound payloads to Near Space
  - Three Versions:
    - 225 - 375 MHz (UHF/FM)
    - 30 - 88 MHz (LVHF/FM)
    - UHF / VHF cross-band payload
  - 65,000 - 100,000 ft operation for 6 to 12 hours
- Training materials and Ground Stations delivered 1Q07
- Active Programs
  - Initial deployment quantities on order
  - U.S. Southern Command
    - Joint Urgent Operational Need – JS approved validation
  - U.S. Central Command
    - Quick Reaction Capability

Payload

Applications for Homeland Security

- Support FEMA, State/Federal agencies in contingencies (power outage, hurricanes, earthquakes, etc.)

- Enhance border and coast monitoring efforts, filling in coverage gaps and tracking assets

- Extend comms and personnel/asset tracking for wildland fires

- Provide extended communications for transportation security

Emergency Response

- Broad communication coverage for recovery management
- Group talk ability
  - Effective at coordinating large number of first responders
- Initial replacement of telecommunications infrastructure
- Bridge comms between federal, state & local authorities

Animation courtesy Air Force Space Battlelab

SkySite® Voice Repeater Kit

- Demonstrated at Assoc. of Public safety Comm. Officers (APCO) Conference
  - August 2006 in Orlando, Florida
- Responsive communications for disaster recovery operations

Demonstrated Coverage of Single Payload to Standard Motorola Handheld Radios at APCO 2006
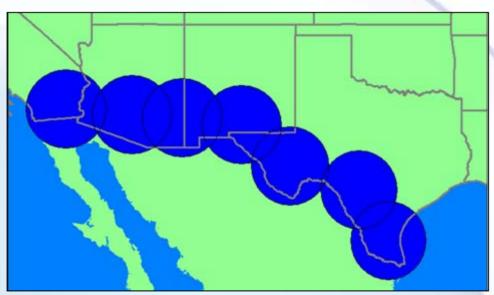
Border Protection

- **Digital, encrypted voice for Border Patrol agents**
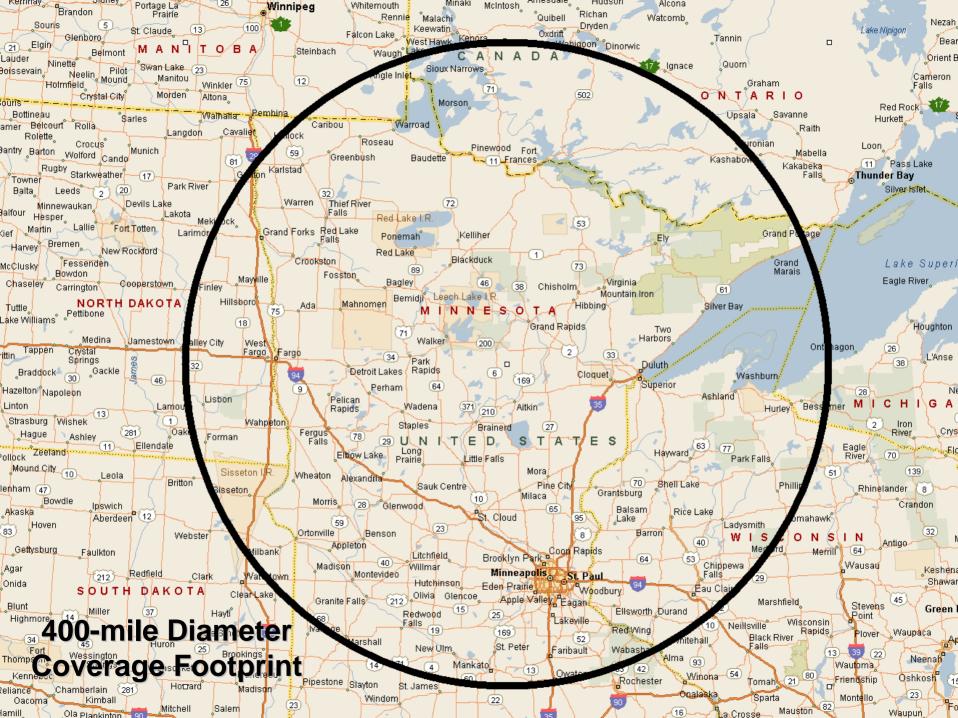
- **Covers deep canyons & extends battery life**

- **Supports agent comms. & asset tracking**

- **Responsively tasked**

400-mile Diameter Coverage Footprint
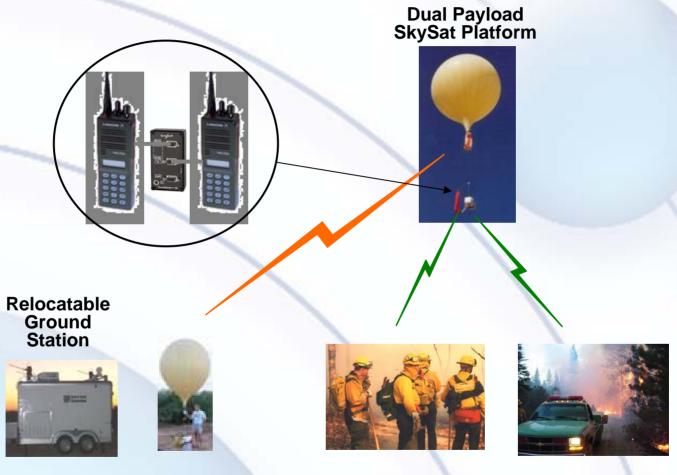
Coastal Protection

- Extend off-shore / international waters comms
- Expanded comms for specific emergency events
- Comms over greater lengths of waterways when needed
- Broader USCG involvement in disaster recovery

Space Data CORPORATION

Coverage for Puget Sound & Straits of Juan de Fuca

Wildland Fires Proof-of-Concept Configuration

Transportation Security

- Asset tracking

- Rapid dissemination of information over broad areas

- Facilitate interoperability

- Coordinate protection activities sector-wide

- Support specific transportation security events

- Support broad secure comms architectures

- Improve security across all modes of transportation

- Support mobile command post

- Coordination across federal, state & local agencies

Space Data
CORPORATION

Typical Near Space Platform Launch

Near Space Platform Applications
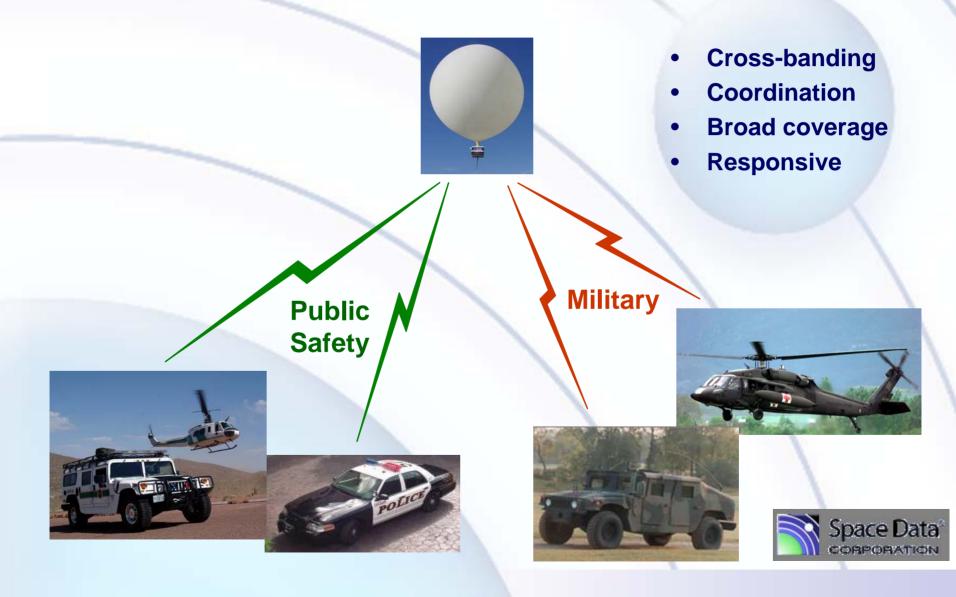
- Emergency Response
- Border Patrol Comm. / ISR
- Wildland Fire Comm/Tracking
- Tactical Ground-to-Ground Comms.
  - Convoy Support
  - Special Operations
- Intelligence, Surveillance & Reconnaissance (ISR)
  - "Truck" to carry special payloads to altitude
  - Visual / IR Imagery
- Tactical Air-to-Ground
  - Supports low-flying aircraft
- High Bandwidth Data Relay
- Other satellite-like missions

Space Data
CORPORATION

Interoperability
Bridging Repeater supports communication between security agencies

- **Cross-banding**
- **Coordination**
- **Broad coverage**
- **Responsive**

Public Safety

Military

Space Data CORPORATION

Good Coverage in Challenging Topography

- 220 Mile link from bottom of Grand Canyon on Aug 3, 2006
  - Used 900 MHz, 2-way handheld radio
  - Only "5 palms" of sky visible
- LEO Sat phone only worked 2 out of 15 min
- Walls too high for GEO Sat Comms.

SkySite at 80,000 Feet

Mile 186 Camp - Aug 3, 2006

Arizona

Phoenix · Space Data - Chandler, AZ

Mexicali

1.3 miles
3921 Feet
5691 ft
1770 ft

Havasu Canyon (no camping within 100 yards upstream 1/2 mile downstream)

Havasu Rapid (3) 3' Drop

Trail to Beaver Falls & Park Boundary. 1.4 Miles (no overnight use)

Mooney Falls   Havasu

Technologie
DigitalGlobe
TerraMetrics

Pointer lat 36.300929° lon -112.620479° elev 4554 ft

Space Data CORPORATION

Applications & Devices

Data Markets	Applications	Devices	Key Benefits
Oil and Gas	Production Automation		• Replaces CDPD being decommissioned this year (75,000 wells losing coverage)
	Asset Tracking		• Monitor assets for greater efficiency & security
	Field Comm.		• Low cost service to coordinate field operations
Industrial Automation	Irrigation		• Control and monitor water usage
	Alarm Systems		• Secure assets inexpensively in remote areas
	Meter Reading		• Read rural utility meters for energy usage
Fleet Tracking	Trailer Tracking		• Low power/small device easily integrates on trailer
	Cargo Tracking		• Track individual pallets using GPS tags
Personal Messaging	In-field work force comm.		• Over 1.1 million compatible devices deployed • New, lower-cost PDAs entering market from Asia

Gov't Markets	Applications	Devices	Key Benefits
Emergency Response	Dispatch service		• Call up police / fire personnel in rural areas • Voice on standard Land Mobile Radios
Homeland Security & Defense	Tracking / Communication		• Track material & soldiers in hostile areas • Encrypted voice communications for military
	Intelligence		• Monitor & triangulate on enemy communications

Space Data CORPORATION

Near-Space: High Resolution, Low Cost

QuickBird 60 cm natural color

$60,000,000 vehicle
$15,000,000 launch

SkySite® natural color demo
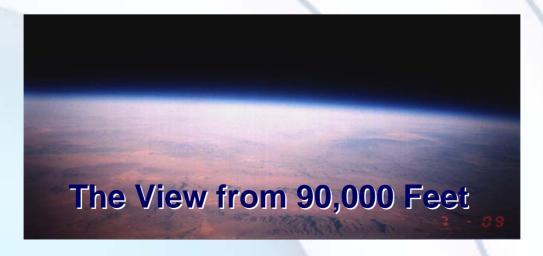
$600 for vehicle construction*
$50 launch*

* Not strictly an apples-to-apples comparison

Conclusion/Recommendations

- Responsive platform exists <u>now</u> to provide broad wireless coverage safely above affected areas
  - No reliance on infrastructure
  - Store until required… launch as needed
- Homeland Security suited payload version available for demo <u>now</u>
  - System can be tailored to specific user needs
- Incorporate into disaster response plans <u>now</u>
  - Experience shows "real time integration" nearly impossible

The View from 90,000 Feet

Space Data
CORPORATION

Private Sector Needs for Food Defense Solutions

Joseph Scimeca

Heartland Security Conference

Minneapolis, MN

July 10, 2007

Cargill

agenda

- food safety vs food defense
- key vulnerabilities
- challenges
- possible solutions

Cargill

food safety vs defense

◆ well positioned for food safety

- ■ unintentional contamination
- ■ food safety infrastructure
- ■ prevention, detection, and response systems
- ■ validated processes
- ■ training and research

☞ no similar system for food defense

Cargill

food safety vs defense

◆ differentiation based upon:

- the accidental vs the intentional

- the chance occurrence vs the malicious intent

- the unplanned vs the deliberate

☞ these are important distinctions to the food industry, particularly with regard to management and prevention practices

Cargill

food safety infrastructure and systems

- food safety programs
  - GAP
  - GMP
  - HACCP
- federal, state, local inspection
- prevent, detection and response systems
  - ☞ lacking in some less developed countries

Cargill

food defense

- ◆ prevention
- ◆ detection
- ◆ response
- ◆ remediation

☞ all depends on adequate planning

Cargill

vulnerabilities

- agricultural production
- storage and transport of raw commodities
- processing and manufacturing
- storage and transportation of products
- wholesale and retail distribution
- food service

Cargill

challenges

- ◆ emphasis on food safety vs security
- ◆ inadequate security personnel
- ◆ lax transportation security
- ◆ off-shore sourcing of food
  - ■ reliance of foreign government oversight
  - ■ limited inspection of imports
- ◆ open access to food at retail/food service

Cargill

challenges

- inadequate public/private sector coordination and planning
- inadequate risk communication planning
- poor connection to intelligence community

Cargill

possible solutions

- ◆ strengthen public/private partnership
  - ■ two-way sharing of info between government and industry
- ◆ multi-sector collaboration
- ◆ international government involvement

Cargill

possible solutions

- develop training and education materials
- define criteria for employee screening
- address vulnerability in food transport systems

possible solutions

- improved procedures to inspect imported food
- development of rapid testing methods
  - deployable in the field
  - broad spectrum
  - capable of testing large samples vs small

Cargill

improved detection

*Discovery*CERT FQS™

- no sampling
- non-destructive
- microbial, chemical, GMO capability

Cargill

possible solutions

- government/industry table top exercises to improve emergency response and communications
- establish local emergency response plans
- establish regular communications among law enforcement, intelligence community, regulators, academia, and industry
- utilize "lessons learned" from food safety incidents

Cargill

food defense

Security is incremental in nature - even small gains in security awareness, practices and procedures contribute to the total security of a company, a sector, a region, a state, and/or a nation
(think public health interventions)

Cargill

Homeland Security Suite (HoSS)
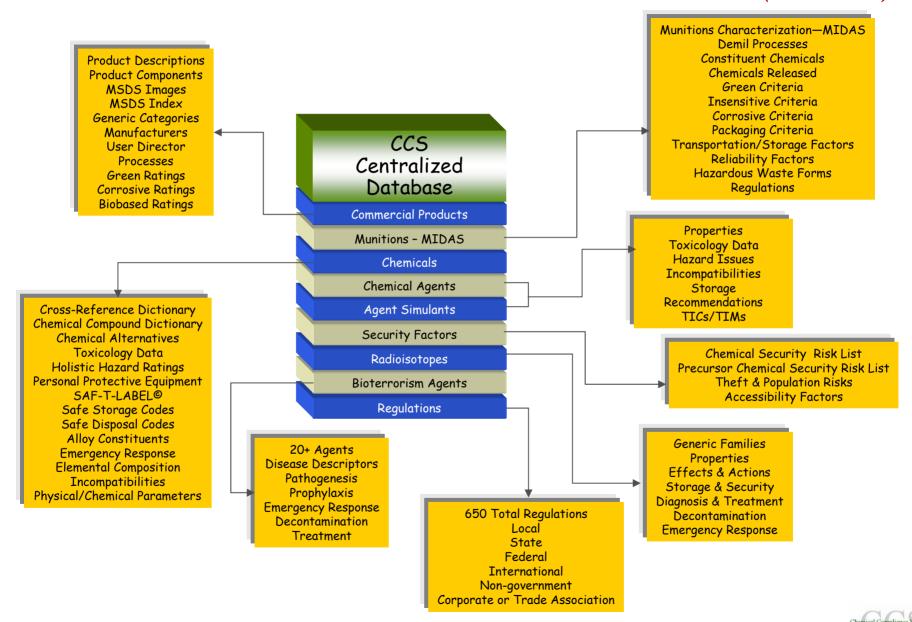
Chemical Biological Radiological

Chemical Compliance Systems

CCS
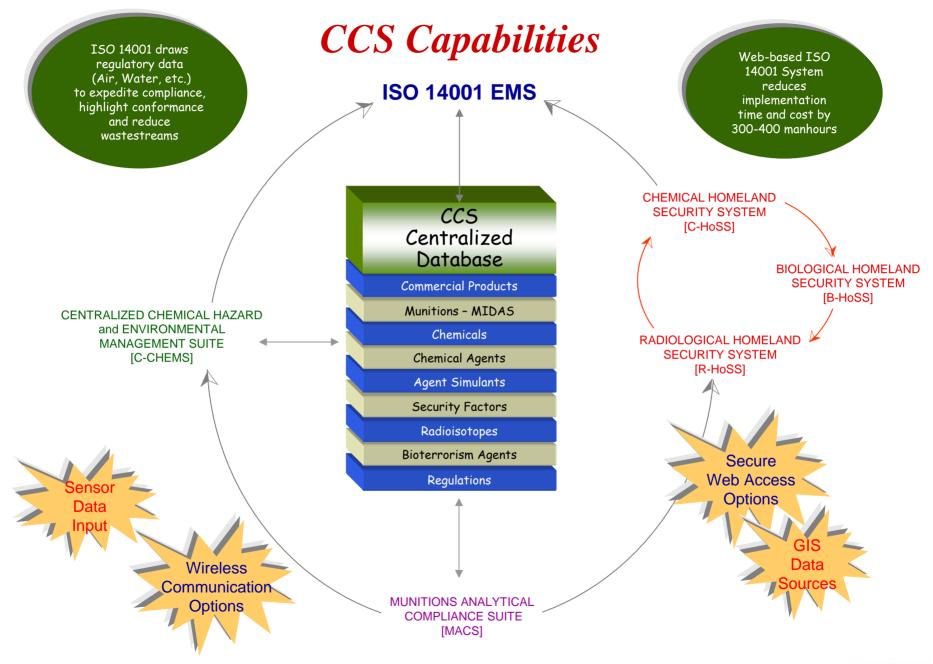
Heartland Security 2007 Conference
July 10, 2007
Minneapolis, MN

George R. Thompson, Ph.D.
CHEMICAL COMPLIANCE SYSTEMS, INC.
Lake Hopatcong, NJ

The CCS Relational Chemical and Product Database (R–CPD)

CCS Centralized Database

- Commercial Products
- Munitions – MIDAS
- Chemicals
- Chemical Agents
- Agent Simulants
- Security Factors
- Radioisotopes
- Bioterrorism Agents
- Regulations

Product Descriptions
Product Components
MSDS Images
MSDS Index
Generic Categories
Manufacturers
User Director
Processes
Green Ratings
Corrosive Ratings
Biobased Ratings

Munitions Characterization—MIDAS
Demil Processes
Constituent Chemicals
Chemicals Released
Green Criteria
Insensitive Criteria
Corrosive Criteria
Packaging Criteria
Transportation/Storage Factors
Reliability Factors
Hazardous Waste Forms
Regulations

Cross-Reference Dictionary
Chemical Compound Dictionary
Chemical Alternatives
Toxicology Data
Holistic Hazard Ratings
Personal Protective Equipment
SAF-T-LABEL©
Safe Storage Codes
Safe Disposal Codes
Alloy Constituents
Emergency Response
Elemental Composition
Incompatibilities
Physical/Chemical Parameters

Properties
Toxicology Data
Hazard Issues
Incompatibilities
Storage
Recommendations
TICs/TIMs

Chemical Security Risk List
Precursor Chemical Security Risk List
Theft & Population Risks
Accessibility Factors

20+ Agents
Disease Descriptors
Pathogenesis
Prophylaxis
Emergency Response
Decontamination
Treatment

650 Total Regulations
Local
State
Federal
International
Non-government
Corporate or Trade Association

Generic Families
Properties
Effects & Actions
Storage & Security
Diagnosis & Treatment
Decontamination
Emergency Response

CCS Capabilities

ISO 14001 draws regulatory data (Air, Water, etc.) to expedite compliance, highlight conformance and reduce wastestreams

Web-based ISO 14001 System reduces implementation time and cost by 300-400 manhours

ISO 14001 EMS

CCS Centralized Database

Commercial Products
Munitions – MIDAS
Chemicals
Chemical Agents
Agent Simulants
Security Factors
Radioisotopes
Bioterrorism Agents
Regulations

CHEMICAL HOMELAND SECURITY SYSTEM [C-HoSS]

BIOLOGICAL HOMELAND SECURITY SYSTEM [B-HoSS]

RADIOLOGICAL HOMELAND SECURITY SYSTEM [R-HoSS]

CENTRALIZED CHEMICAL HAZARD and ENVIRONMENTAL MANAGEMENT SUITE [C-CHEMS]

Sensor Data Input

Wireless Communication Options

MUNITIONS ANALYTICAL COMPLIANCE SUITE [MACS]

Secure Web Access Options

GIS Data Sources

CCS
Chemical Compliance Systems

CCS Homeland Security Systems (HoSS)

CCS Centralized Database

Organisms

Radioisotopes

Chemicals

BIOLOGICAL HOMELAND SECURITY SYSTEM (B–HoSS)

- Preparation & Planning
- Surveillance
- First Responders
- Hospital Staff
- Laboratory
- Risk Assessment
- Emergency Response
- Training

CHEMICAL HOMELAND SECURITY SYSTEM (C–HoSS)

- Security & Containment
- Chemical Tracking
- Munitions Suite
- Hazardous Waste
- Storage Tanks
- Air
- Water
- Pesticides
- Toxics
- Industrial Hygiene
- Chemical Safety
- Solid Waste

RADIOLOGICAL HOMELAND SECURITY SYSTEM (R–HoSS)

- Preparation & Planning
- Surveillance
- First Responders
- Hospital Staff
- Security
- Risk Assessment
- Emergency Response
- Training

Sensor Data Input

Wireless Communication Options

Secure Web Access Options

GIS Data Sources

Biological Homeland Security System (B–HoSS)

Preparation & Planning
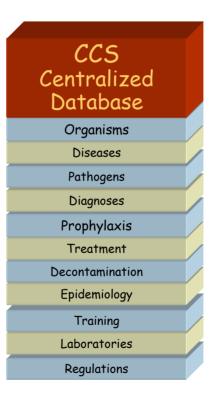
Community
Healthcare
Local/State/Federal

Training

First Responders
Military
Healthcare

Emergency Response

Local
Regional
National

Risk Assessment

"What If" Scenarios
Experiment Analyses

CCS Centralized Database

Organisms
Diseases
Pathogens
Diagnoses
Prophylaxis
Treatment
Decontamination
Epidemiology
Training
Laboratories
Regulations

Surveillance

Data Input
Illness Recognition
Exposure Routes

First Responders

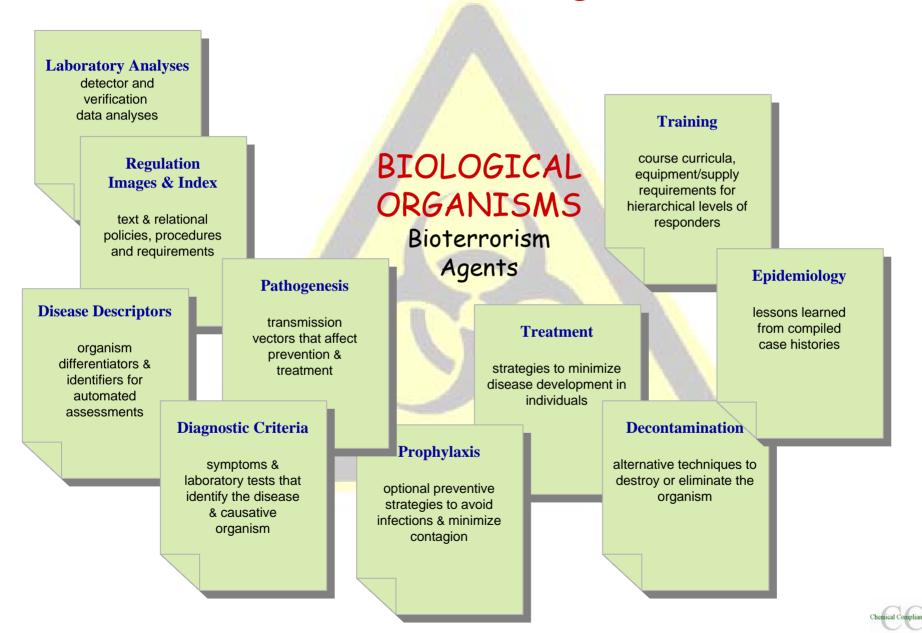Observed Features
PDA Utility
BEST

Hospital Staff

Information Retrieval
Diagnosis
Treatment

Laboratory

Testing
Biosafety/Training
Regulations

The CCS Relational Biological Database

BIOLOGICAL ORGANISMS

Bioterrorism Agents

Laboratory Analyses
detector and verification data analyses

Regulation Images & Index
text & relational policies, procedures and requirements

Disease Descriptors
organism differentiators & identifiers for automated assessments

Pathogenesis
transmission vectors that affect prevention & treatment

Diagnostic Criteria
symptoms & laboratory tests that identify the disease & causative organism

Prophylaxis
optional preventive strategies to avoid infections & minimize contagion

Treatment
strategies to minimize disease development in individuals

Decontamination
alternative techniques to destroy or eliminate the organism

Training
course curricula, equipment/supply requirements for hierarchical levels of responders

Epidemiology
lessons learned from compiled case histories

Chemical Compliance Systems

Radiological Homeland Security System (R–HoSS)

Preparation & Planning

Community
Healthcare
Local/State/Federal

Training

First Responders
Military
Healthcare

Emergency Response

Local
Regional
National

Risk Assessment

"What If" Scenarios
Experiment Analyses

CCS Centralized Database

Radioisotopes
Biological Effects
Surveillance Data
Treatment Regimens
Decontamination Protocols
Training
Laboratories
Regulations

Detectors

Data Input
Illness & Burn Treatment
Exposure Routes

First Responders

Observed Features
PDA Utility
Data Transfer

Hospital Staff

Information Retrieval
Diagnosis
Treatment

Security

Testing
Radiological-Safety/Training
Regulations

The CCS Relational Radiological Database

RADIOLOGICAL
Terrorism
Prevention & Treatment

Detection & Measurement

data compilation

Emergency Response

hierarchical control & clean-up strategies

Decontamination

alternative techniques to remove radiological agents

Treatment

strategies to minimize exposure & treat exposure effects

Training

course curricula equipment/supply requirements for hierarchical levels of responders

Lessons Learned

compiled from case histories

Regulation Images & Index
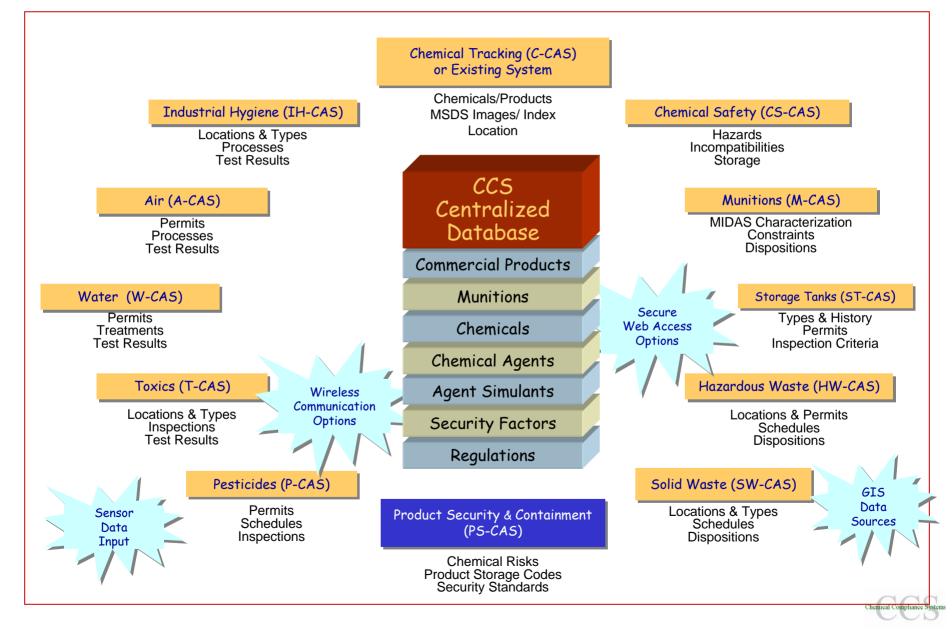
text & relational policies, procedures & requirements

Chemical Compliance Systems

Chemical Homeland Security System (C–HoSS)
Centralized & Relational Databases

Chemical Tracking (C-CAS) or Existing System

Chemicals/Products
MSDS Images/ Index
Location

Industrial Hygiene (IH-CAS)

Locations & Types
Processes
Test Results

Chemical Safety (CS-CAS)

Hazards
Incompatibilities
Storage

Air (A-CAS)

Permits
Processes
Test Results

Munitions (M-CAS)

MIDAS Characterization
Constraints
Dispositions

CCS Centralized Database

- Commercial Products
- Munitions
- Chemicals
- Chemical Agents
- Agent Simulants
- Security Factors
- Regulations

Water (W-CAS)

Permits
Treatments
Test Results

Storage Tanks (ST-CAS)

Types & History
Permits
Inspection Criteria

Secure Web Access Options

Wireless Communication Options

Toxics (T-CAS)

Locations & Types
Inspections
Test Results

Hazardous Waste (HW-CAS)

Locations & Permits
Schedules
Dispositions

Sensor Data Input

Pesticides (P-CAS)

Permits
Schedules
Inspections

Product Security & Containment (PS-CAS)

Chemical Risks
Product Storage Codes
Security Standards

Solid Waste (SW-CAS)

Locations & Types
Schedules
Dispositions

GIS Data Sources

Regulated Hazardous Chemicals
Acute Hazard Orientation

Chemical Agents
Neurotoxins
Extreme
Toxins
Radioactives
Explosives
Shock Sensitives
Corrosives
Flammable
Oxidizers
Hazardous Air Pollutants
Persistent Bioaccumulative Toxins
Priority Pollutants

Chemical Security Risks List

ACGIH
DEA
DOT
EPA
OSHA
California
Iowa
Maryland
Nevada
New Jersey
European Community

CPSC Specialty Regulated Substances

Canada Export Control Lists

DEA Essential Chemicals

DEA Precursor Chemicals

DOC Export Restrictions

EU Black/Gray Lists

IATA Air Transport Forbidden

IATA Passenger Transport Forbidden

IATA Regulated Substances

UK The Red List (Water)

UN/FAO Prior Informed Consent

Precursor Chemical Security Risks List

C-HoSS
Generic Chemical Hazard Classes

- **Explosives**

- **Chemical Agents**

- **Extreme Toxins**

- **Neurotoxins**

- **Radioactives**

- **Corrosives**

- **Flammables**

- **Water Reactives**

- **Oxidizers**

- **Persistent Bioaccumulative Toxins**

- **Priority Pollutants**

- **Hazardous Air Pollutants**

Hazard Class Ranking Data Elements

PROPERTIES	TOXICOLOGY DATA	HAZARDS	INCOMPATIBILITIES	STORAGE RECOMMENDATIONS
— Structure — Chemical — Physical	— Human — Animal — In Vitro	— Protection — Decontamination — Persistence — Use	— Chemical — Conditions — Containers	— Container — Conditions — Distances — HSAS[a] Variables

[a] HSAS = Homeland Security Advisory System

Toxic Industrial Chemicals/Toxic Industrial Materials
(TICs/TIMs)

Selected Examples

Industrial Feedstocks:	**Acrylamide, Chlorine, Hydrogen Chloride, Phosgene**
Carbamate Insecticides:	**Baygon, Mobam, Temik, Zectran**
Organochlorine Insecticides:	**Aldrin, Dieldrin, Endrin, Lindane, Heptachlor**
Organophosphate Insecticides:	**Disulfotan, Mevnphos, Parathion, Methylparathion**
Insecticide Synergists:	**Piperonyl Butoxide**
Fungicides:	**Pentachlorophenol, Hexachlorobenzene, Maneb, Naban, Zineb**
Fumigants:	**Calcium Cyanide, Methyl Bromide, Phosphine**
Seed Disinfectants:	**Methylmercury Acetate, Methylmercury Cyanide**

GOALS: [1] Identify all chemicals with severe to extreme acute toxicity
         [2] Identify all chemicals in product classes with similar mechanisms of action

Chemical Compliance Systems

Incompatible Chemical Database
(CCS Published Book)

CHEMICAL CLASS	CHEMICAL	INCOMPATIBLE CHEMICAL	I.C. CLASS	INTERACTION HAZARD
Corrosives	Acetic Acid Nitric Acid Chlorine	Hydrogen Peroxide Acetylene Aluminum Powder	Oxidizer Flammable Metal	Explosion Explosion Spontaneous Fire
Flammables	Acetone Benzene Carbon Disulfide	Chloroform Chlorine Potassium	Carcinogen Corrosive Flammable	Explosion Explosion Violent Explosion
Reactives	Nitrotoluene Nitroethane Acrylonitrile	Sulfuric Acid Hydrocarbons Bromine	Corrosive Combustible Corrosive	Explosion Explosion Explosion
Products	Toilet Bowl Cleaner Bleach Paint Solvent	Metal Powders Ammonia Chloroform	Metals Product Carcinogen	Explosion Poisonous Gas Explosion

Chemical Security Procedures

Security Procedure Phases

Phase I — **Vulnerability Assessment**
Identify chemical hazards, security risks, mortality risks

Phase II — **Countermeasures Implementation**
Reduce vulnerabilities

Phase III — **Verification Audit**
Independently confirm countermeasure adequacy

Phase IV — **Management System Integration**
Integrate chemical security procedures into line management functions

C-HoSS Security Criteria & Standards

- **Chemical Hazard Class Rankings (*by Hazard Class*)**
- **Chemical Hazard Grades (1–4) (*within each ranking*)**
- **Product Concentration Grades (1–4)**

Chemical Hazard Factor (CHF) = Ranking ℗ Grade ℗ Concentration

- Theft Risk Grades (1–4) (*per product*)

Chemical Security Risk Factor (CSRF) = Ranking ℗ Grade ℗ Concentration ℗ Theft Risk

- Population at Risk Grades (1–4)

Chemical Mortality Risk Factor (CMRF) = Ranking ℗ Grade ℗ Concentration ℗ Theft Risk ℗ Population Risk

- Accessibility Factor Levels (*Storage Constraint Levels and Descriptors*) (0.5–4.5)

CMRF ☽ Accessibility Factor (AF) = Vulnerability Factor (VF)

C–HoSS
Capabilities *vs.* Chemical Security Procedures

SECURITY PROCEDURE PHASES	C–HoSS CAPABILITIES
PHASE I **Vulnerability Assessment** *Identify chemical hazards, security risks, mortality risks*	Chemical Hazard Factor Report Chemical Security Risk Factor Report Chemical Mortality Risk Factor Report Chemical Vulnerability Risk Factor Report
PHASE II **Countermeasures Implementation** *Reduce vulnerabilities*	Accessibility Factor (Storage Constraint) Report (per chemical/material)
PHASE III **Verification Audit** *Independently confirm counter measure adequacy*	Chemical Vulnerability Factor "Report Card" (to the local fire department)
PHASE IV **Management System Integration** *Integrate chemical security procedures into line management functions*	Integration of C–HoSS w/ chemical tracking system Daily C–HoSS correlation w/ Homeland Security Advisory System

CCS Database Security & Privacy

1.   Hardware Barriers

2.   User Authorization Controls

3.   Firewalls

4.   Intrusion Detection

---

5.   Digital Certification

                                        Reduce System
                                        Performance
                                        30–35%

6.   Encryption

For more information, please contact . . .

Dr. George Thompson

georgethompson@chemply.com
973-663-2148
973-663-2378 (fax)

Chemical Compliance Systems

We have made minimal progress toward the establishment of a seamless information sharing system. You can change the law, you can change the technology, but you still need to change the culture; you need to motivate institutions and individuals to share information."

The Honorable Lee H. Hamilton
Vice Chairman, 9-11 Commission
In testimony before the U.S. House of Representative
Subcommittee on Intelligence, Information Sharing and Terrorism
November 8, 2005

The Federal government has not yet realized the value of information identified by state and local entities. A system to integrate this information has not been developed. Much more attention has to be paid to this gap, because we as a government are ignoring a critical component of national security.

William P. Crowell
The Markel Foundation Task Force on
National Security in the Information Age
In testimony before the U.S. House of Representative
Subcommittee on Intelligence, Information Sharing and Terrorism
Nov 8, 2005
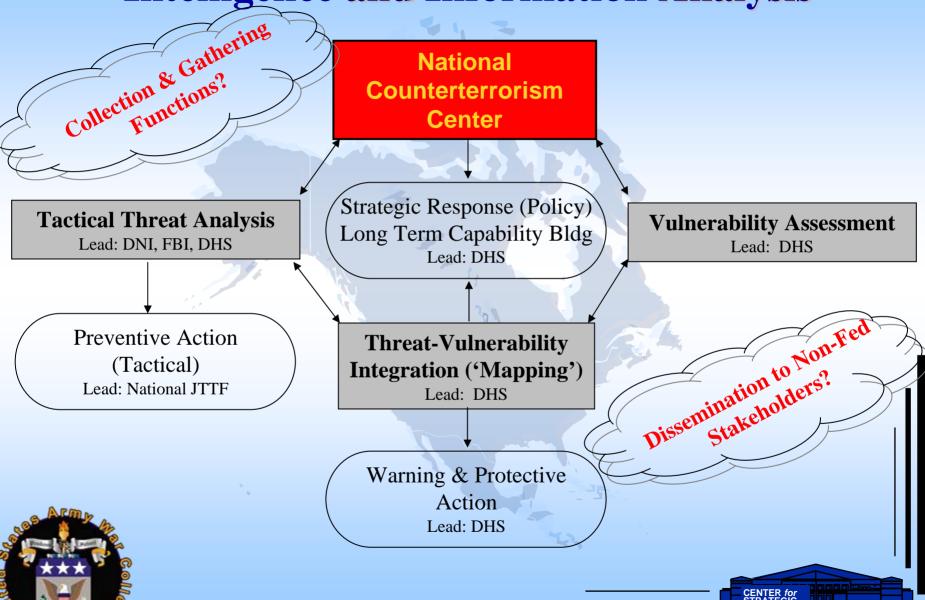
The guiding principle of intelligence reform since the attacks of September 11, 2001 is <u>Integration</u>.

The Honorable Charles E. Allen
In testimony before the U.S. House of Representative
Homeland Security Committee
Subcommittee on Intelligence, Information Sharing and Terrorism
24 May 2006

CENTER *for*
STRATEGIC
LEADERSHIP

Intelligence and Information Analysis

Collection & Gathering Functions?

National Counterterrorism Center

Tactical Threat Analysis
Lead: DNI, FBI, DHS

Strategic Response (Policy)
Long Term Capability Bldg
Lead: DHS

Vulnerability Assessment
Lead: DHS

Preventive Action
(Tactical)
Lead: National JTTF

Threat-Vulnerability Integration ('Mapping')
Lead: DHS

Dissemination to Non-Fed Stakeholders?

Warning & Protective Action
Lead: DHS

United States Army War College

CENTER *for* STRATEGIC LEADERSHIP

NCTC as the Answer?

The Intelligence Reform and Terrorism Prevention Act of 2004 assigned to the National Counterterrorism Center the responsibility "to ensure the agencies, as appropriate, have access to and receive all-source intelligence products needed to execute their counterterrorism plans, or perform independent, alternative analysis…" and "to ensure that such agencies have access to and receive intelligence needed to accomplish their assigned activities."

NCTC statutory authorities are limited to sharing with Federal organizations.
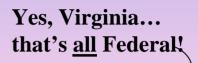
NCTC AND Information Sharing:
Five Years Since 9/11: A Progress Report, September 2006

Still Too "Federal Centric?"

- Solutions from the IRTPA:
  - FBI National Security Branch
  - National Counterterrorism Center
  - DHS Office of Intelligence and Analysis

- Program Manager for the Information Sharing Environment

- Dilemma: Inability to stipulate the activities of State, Local and Private Sector entities into a national strategy

Yes, Virginia… that's _all_ Federal!

CENTER *for* STRATEGIC LEADERSHIP

Is there a national intelligence role for "non-traditional players?" (State, Local, Private Sector).
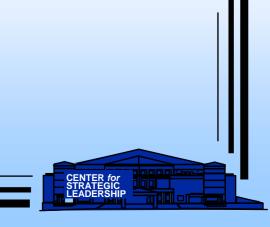
- Interagency
- Intergovernmental
- Intersector

- Need to Know
- Need to Share
- Responsibility to Provide

SAFE*Life* **Corp.**

Triosyn Iodinated Resin
Incorporated Into Disposable
Respirators
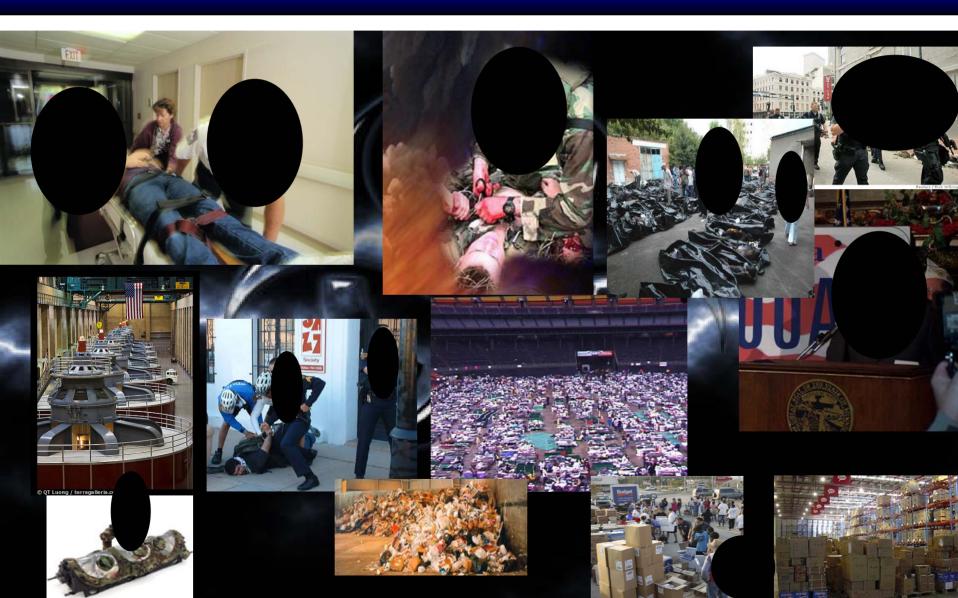
Objective

- To increase awareness of the need for better respiratory protection against viral hazards relevant to potential Medical and Bio-weapon threats

SAFELife

Care Givers During SARS

- Healthcare providers acquired SARS despite despite masks and respirators

Toronto	51%
Hanoi	63%
Hong Kong	46%

Currently $600,000,000 Toronto law suits

SAFELife

Exposure Potential

- Inhalation: Suck in air like a vacuum cleaner
    - 6 liters/min.   (1½ gallons)
    - 360 liters/hr.   (90 gallons)
    - 2,880 liters/8hr shift   (720 gallons)!
- 300 million alveoli (air sacs) in adult lung
    - surface area if each opened = ~140 sq. yards = tennis court!
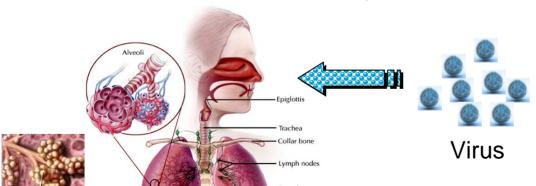
Virus

SAFELife

Mission Critical:
Protect Vulnerable Respiratory Access Route

Protect Our Protectors

SAFELife

PAPRs, SCBA, Disposable Respirators, Masks

SAFELife

Balazy 2006

Penetration of virus at 85 LPM		If 10,000 viruses in inhaled air/4 hours
■ 20.5%	(A) Mask	2,050
■ 84.5%	(B) Mask	8,450
■ 5.6%	(D) Respirator	560

Balazy A., *Amer Jour Infect Control* 2006; 34: 52-57
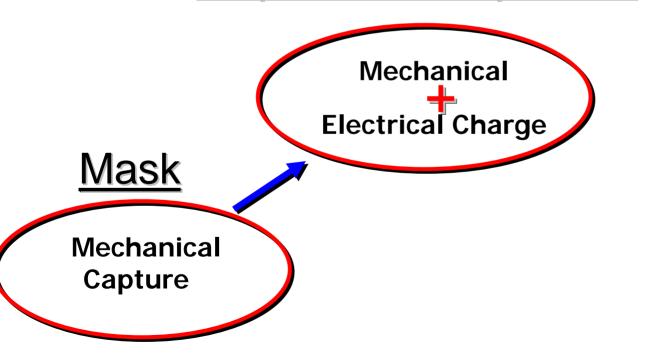
Potential Airborne Viral Threats	Infectious Dose	Associated Diseases	Size Comparison Representation
Ebola & Marburg; Crimean Congo Bolivian; Rift Valley Fever; New World Arenavirus; Hantavirus; Lassa; Yellow Fever;	1-100	Viral hemorrhagic fever (VHF) Infectious dose	
Eastern, Western & Venezuelan Equine Encephalomyelitis (EEE, WEE, and VEE) viruses	10-100	Viral encephalitis	
Adenovirus	1-100	Respiratory infections, tumors	
Influenza A virus; Avian flu H5N1, H2N2, H1N1, H3N2, etc.	1-740	Influenza	
SARS Coronavirus	1-100	Sudden Acute Respiratory Syndrome (SARS)	
Variola virus	10-100	Smallpox	
Mycobacterium tuberculosis (TB)	1-10	Pulmonary tuberculosis First time N95s in healthcare	

SAFELife

Mechanical + Electrostatic Charge

Gravitation

Impaction

Diffusion

Electrical charge
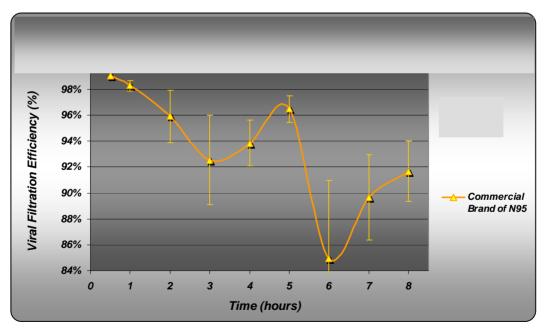
Standard N95 Performance Degradation

- The electrostatic charge degrades over time and with different contaminates decreasing efficacy

Velocity of viral challenge: 85 LPM equivalent
Challenge: MS2 virus at approximately 1,000,000 pfu per hour
Duration: 8 hours

12

How Do You Ruin The Electret Charge On Filters?

- Water
- Moisture
- Time
- Heat
- Oil based products, diesel mist, vaporized fatty tissue
- Alcohol
- <u>Most disinfectants</u>
- Overwhelm with captured particles; stuff

Your Own Experiment!

Myers DL. *Electret Media for HVAC Filtration Applications.* INJ Winter 2003; 43-54

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Set Up For "Migration and Dump"

- Fibers adsorb exhaled moisture

- Moisture accumulates to form minute droplets on fibers

- Fiber's electrostatic charge begins to decay and with it

  – Decrease in capture efficiency

  – Decrease in microbe retention
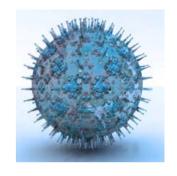
Exhalation Moisture
An Arctic Visual
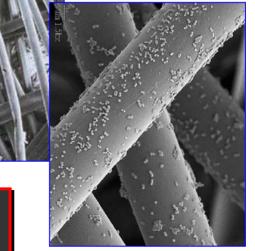
A Journey Begins
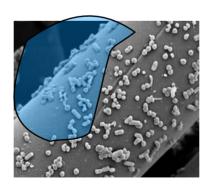
Microorganisms Are Captured, But Alive On the Fibers

15

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Accumulation

- The droplets continue to expand soaking off more and more virus and bacteria already retained on the fibers

- Remember, they are still alive
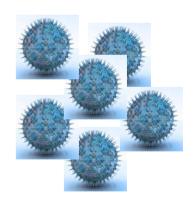
Migration and Dump

- Growing droplets reach critical mass and are pulled into the air stream, where they may be:
    - impaled onto another fiber (droplet break apart)
    - pushed back out into the environment (exhalation)
    - inhaled by the wearer (inhalation)

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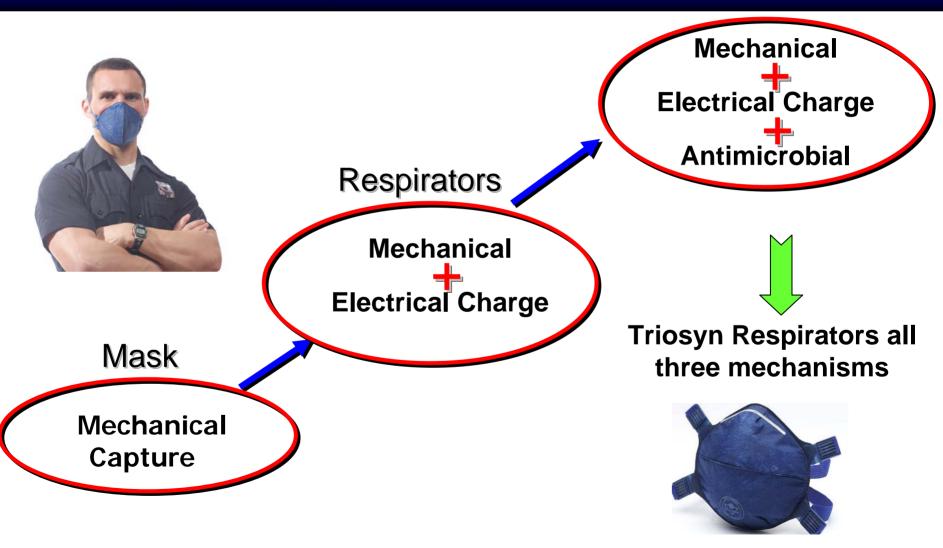
Mechanical + Electrostatic Charge + Antimicrobial

Most penetrating aerosol size: 0.3 microns

Gravitation

Impaction

Diffusion

Triosyn treated fibers

X

X

Electrical charge

Technological Progress In Respiratory Protection

Respirators

Mask

Mechanical Capture

Mechanical + Electrical Charge

Mechanical + Electrical Charge + Antimicrobial

Triosyn Respirators all three mechanisms
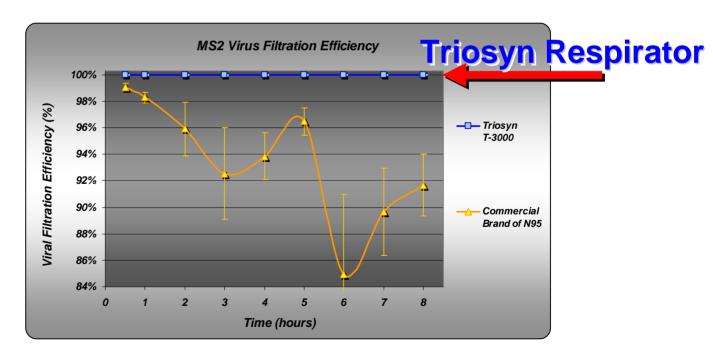
Antimicrobial Preserves Efficacy

- Counteracts the degradation affect – preserves the respirator

- Preserves higher microbial capture efficiency and prevents migration
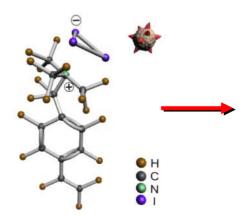
8 hours

85 LPM when

Challenged with 1,000,000 viruses per hour

MS2 Virus Filtration Efficiency

Triosyn Respirator

- Triosyn T-3000
- Commercial Brand of N95

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Triosyn Antimicrobial Technology
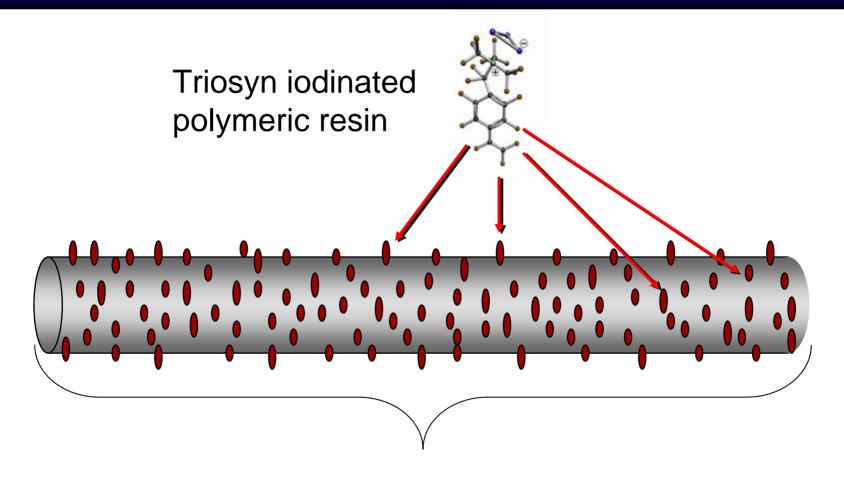
- Iodine (I_2) is a fast acting, broad spectrum antimicrobial utilized for wound treatment and infection prevention since the 1800s

- Historically unable to keep iodine stable over time

- Tri-iodide is thermal-fused into unique polymeric resin particles: polystyrene-4-methyltrimethylammonium-triiodide

SAFELife
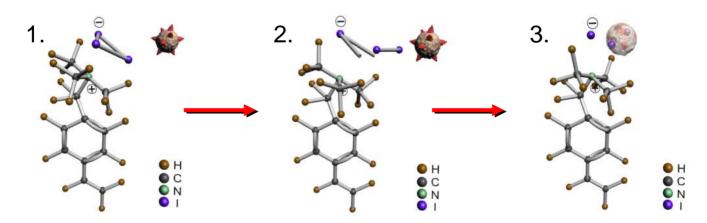
Triosyn Antimicrobial Resin On Fibers

Triosyn iodinated polymeric resin

Respirator Filtration Fiber

SAFELife

- Electrochemical bond maintains I_3^- integrity and sets up a demand–release mechanism

- I_2 is released from the I_3^- in the presence of microoganisms (direct contact not necessary)
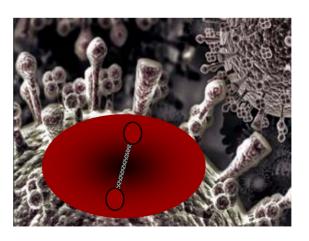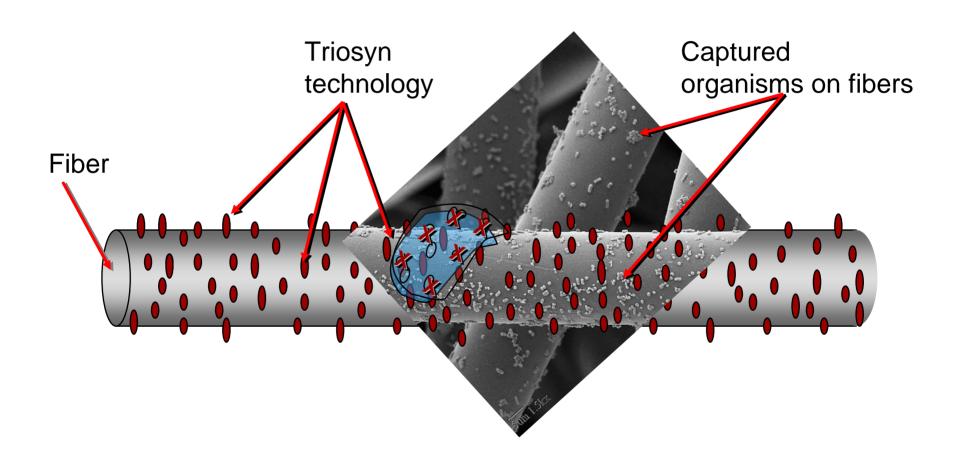
Triosyn Action

- Drawn to the surface of the microorganism

- Iodine (I_2) **oxidizes** surface and key external and internal components of the cell

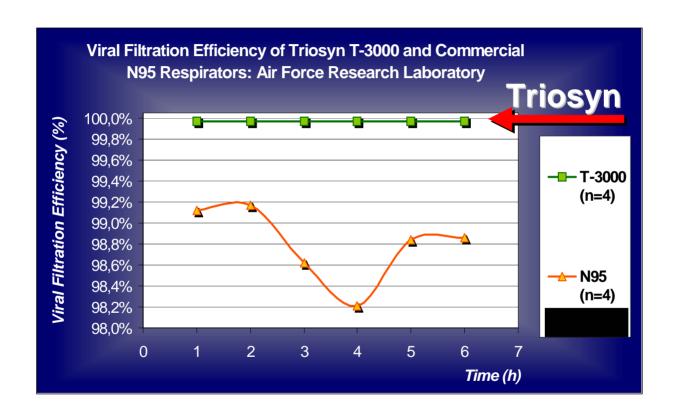- Affective against viruses, bacteria, fungi, protozoa

Avian Flu Virus

Triosyn Iodinated Resin: Addresses Both Passing Air and "Migration and Dump"

Triosyn technology

Captured organisms on fibers

Fiber

25

Air Force Research Lab Testing

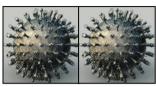Viral Filtration Efficiency of Triosyn T-3000 and Commercial N95 Respirators: Air Force Research Laboratory

Flow Rate: 85 LPM for 6 hours

Virus: MS2 (as per Governmental agencies protocols)

Air Force Research Laboratory (AFRL), Panama City, Florida

Efficacy Comparisons

Filtration Efficiency	Airborne Viral Exposure			
	100	1,000	10,000	100,000
99.999%	0.001*	0.01	0.1	1
99.90 %	0.1	1	10	100
99.00 %	1	10	100	1,000
95.00 %	5	50	500	5,000
90.00 %	10	100	1,000	10,000
20.00%**	80	800	8,000	80,000

*Viruses penetrating through respirator/mask

* *20% represents the results of a face mask
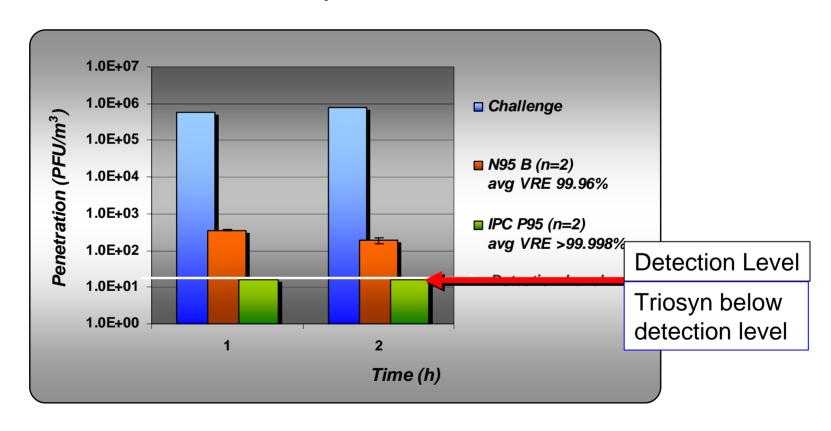
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Aerosolized SARS Coronavirus

Sampling Time (min)	Positive Control — Total TCID$_{50}$ Units	Triosyn Respirators					
		Sample 1 (Total TCID$_{50}$ Units)	Sample 2 (Total TCID$_{50}$ Units)	Sample 3 (Total TCID$_{50}$ Units)	Sample 4 (Total TCID$_{50}$ Units)	Sample 5 (Total TCID$_{50}$ Units)	Sample 6 (Total TCID$_{50}$ Units)
15	3,000	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
60	30,000	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
120	150,000	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
Total	183,000	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected

- 85 LPM for two hours with increasing level of SARS Coronavirus challenge
- No viruses detected during continuous collection of the air after passage through Triosyn Respirators (6 respirators tested).

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Influenza A

Influenza penetration levels through Triosyn P95 and Commercial N95 Respirators tested 85 LPM

M06-0246 ;July 5th 2006

NIOSH testing determines Particle Filtration Efficiency of the Respirator fabric, not the finished product

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Appropriate Parameters For Testing Barrier Effectiveness Against Viruses

- Appropriate preconditioning

- 0.05 to 0.1 micron inert particle challenge

- 0.05 to 0.1 micron viral aerosol challenge (virus in aerosol will be smaller, e.g. MS2)

- High humidity to reflect exhalation moisture

- 85 LPM (NIOSH) equivalent face velocity

- 3 to 24 hour test duration

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Triosyn Antimicrobial Technology

- Broad spectrum: bacteria, fungi, viruses and protozoa

- Rapid activity able to interact with microorganisms in air stream passing at 85 LPM

- Biocidal (kills microorganisms) - not, just static (putting germ into hibernation)

- Bio-compatible at extended-use exposure levels

- An antimicrobial with long term use-history and expectations in a harnessed format

- Not known to instigate <u>antibiotic</u> resistance

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Triosyn Antimicrobial Technology

- No development of microbial-resistance to the antimicrobial has occurred to Triosyn iodinated resin

- Stable in expected manufacturing, shipping, storage, environmental and use conditions

- Effective for entire duration of use of the respirator with negligible efficacy degradation and acceptable ease of breathing – can be adjusted depending on product

- Antimicrobial not a constant leach out, but is instead delivered as needed

Reasons for Having Triosyn Disposable Respirators Available

- Exposure to serious natural or manmade airborne infectious microorganisms or infected individuals

- Threat of airborne bioterrorist attack

- Working with symptomatic poultry or other animal vectors

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Reasons for Having Triosyn Disposable Respirators Available

- Cleaning up after natural disasters
  - Floods   - Hurricanes   - Earthquakes
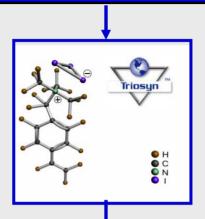
- Cleanup after manmade disasters
  - Explosions   - Bioterrorism

- When faced with odor and nuisance fumes

  - Cleanup - CSI - Mortuary - 1st responders

- Stock to ensure access when (not if) pandemic strikes or bioterrorist attack occurs

Safe Life and Triosyn Research

Innovative Product Development for the 21st Century
Various stages of product development and commercialization

Defense / Military

- **Troop shelters**
- **Patient transports**
- **Body bags**
- **Canteen filters**
- **Shoe innersoles**

Air Filtration

- **Respirators**
- **Gas Mask Canisters**
- **HVAC Systems**

Industrial

- **Lubricant Filters**
- **Paints & Coatings**
- **Decontamination**
- **Barriers & Textiles**

Medical-Hemo

- **Treatment**
- **Transfusion**

Medical-Topical

- **Wound Management**
- **Wound Dressings & Burn Wraps**
- **Topical Preparations**

Microbiological Performance

Microoganisms tested against Triosyn Air Filtration or Antimicrobial Finishes

Viruses	Bacteria	Bacterial spores	Fungi
Φx174 Coliphage MS2 Coliphage Newcastle Disease Virus SARS coronavirus Avian & Human Influenza	*Erwinia herbicola* *Escherichia coli* *Klebsiella pneumoniae* *Klebsiella terrigena* *Micrococcus luteus* *Staphylococcus aureus* *Staphylococcus epidermidis*	*Bacillus atrophaeus (BG)* *Bacillus subtilis*	*Aspergillus niger* *Candida albicans* *Cladosporium herbarum* *Rhodotorula rubra* *Trichophyton mentagrophytes*

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Microbiological Performance

Microoganisms tested against Triosyn Products

Viruses	Bacteria	Bacterial Spors	Fungi	Protozoa
Φx174 Coliphage **Human Immuno.** **Virus (HIV)** **MS2 Coliphage** **Newcastle** **Disease Virus** **Poliovirus Type 1** **Rotavirus SA-11** **SARS coronavirus**	*Brucella abortus* *Enterobacter aerogenes* *Enterococcus faecalis* *Erwinia herbicola* *Francisella tularensis* *Klebsiella pneumoniae* *Klebsiella terrigena* *Legionella sp.* *Micrococcus luteus* *Drug-Res. Staphy. aureus (MRSA)* *Proteus mirabilis* *Pseudomonas aeruginosa* *Pseudomonas pseudomallei* *Salmonella sp.* *Serratia marcescens* *Shigella flexneri* *Staphylococcus aureus* *Staphylococcus epidermidis*	*Bacillus anthracis* *Bacillus atrophaeus (BG)* *Bacillus subtilis*	*Aureobasidium pullulans* *Aspergillus niger* *Candida albicans* *Cladosporium herbarum* *Penicillium citrinum* *Penicillium sp.* *Rhodotorula rubra* *Trichophyton mentagrophytes*	*Cryptosporidium parvum* *Giardia lamblia* *Giardia muris*

SAFE Life Corp.

Triosyn Iodinated Resin Incorporated Into Disposable Respirators